IMPERIAL FORESTRY BUREAU

FORESTRY ABSTRACTS

VOLUME I NUMBER 3

Published by the
IMPERIAL FORESTRY BUREAU, OXFORD
1940

INTRODUCTION

As announced in the September number of the *Current Monthly Record*, that publication is to be discontinued after December 1939, and all available current literature will be recorded in *Forestry Abstracts*. The literature to be recorded and abstracted will include not only current accessions to the library of the Imperial Forestry Institute but also relevant material from other libraries in this country with which the necessary agreement can be made. Under this arrangement there has been a considerable increase in the amount of material available for examination. However, it is not considered necessary that every paper should be abstracted, and it will be found that in the present issue of *Forestry Abstracts* quite a number of papers are recorded by title only. This treatment applies particularly to four types of articles: (*a*) scientific papers that are concerned with the basic problems of a separate though related science, such as Entomology, and are not of direct interest to Forestry; (*b*) monographs, which by their very nature are impossible to abstract usefully; (*c*) papers that review one or more topics of general interest but do not make any addition to knowledge; and (*d*) papers that are mainly lists and tables of data the nature of which is clearly indicated by the title.

Abbreviations for the titles of periodicals, bulletins, &c., which were used in the first two numbers of *Forestry Abstracts*, followed the practice of the Imperial Forestry Institute in the *Forest Bibliography* published in 1936. It has now been decided to use the abbreviations given in the second edition of the *World List of Scientific Periodicals* published by the Oxford University Press in 1934, and a list of abbreviations for the literature dealt with in the present number is given on the last three pages. A few publications were not found in the *World List*, but in all cases the abbreviations were compiled from similar titles contained therein.

Two other additions have been made. When the original title of a foreign paper can be written in Roman type it will be given above the translation; this has not been possible in every case in this number; for papers that are of special interest or technical value, the address is given of the institution, university, or research station at which the work was done. This information should be of use to the reader who wishes to obtain the original paper or to make direct contact with the author.

Lines 27 and 28, p. 210, should read :—

United States [1]. Optimum conditions for the extraction of White Pine seed are maximum relative humidity of 40 per cent. and temperature 40° F. [*sic* 140° F. ? Ed.] for 8 to 12 hours.

FORESTRY ABSTRACTS

VOLUME I 1939 NUMBER 3

RECENT PROGRESS IN DETERMINING THE VIABILITY OF FOREST TREE SEEDS

GERMINATION has been the usual method of testing viability in forest tree seeds. Whatever type of germinating apparatus is employed the method suffers from certain serious defects. Tests are slow for many species and dormant seeds must be subjected to long periods of after-ripening before they can be tested intact; expensive equipment is required to supply each kind of seed with appropriate conditions in the testing-rooms, and the germination percentage itself varies widely with conditions and type of apparatus. The germination test, while furnishing direct information on the inherent capability of the seed to germinate, can yield only indirect evidence of the plant percentage to be expected in the field, and extensive statistical investigations on the relation between germination and plant percentage have not made it possible to predict with any certainty the behaviour of the individual case in the field.

As early as 1876 Dimitriewicz turned to chemicals as a means of estimating viability. He observed that when sulphuric acid, of a certain concentration, was applied to the cut sections of grain seeds a rose colour was produced, which developed much faster in viable seeds than in those of poor quality. There followed a long succession of investigators attempting to use various criteria such as respiratory activity of grains, amount of heat given off under certain conditions, electrical response (Waller's 'blaze currents') and conductivity, sugar content, catalase activity, &c. Other workers, as for example Flemion, excised dormant embryos and attempted to germinate them in various media with more or less success. Numerous methods were devised to hasten germination by removing or reducing mechanical obstacles (cf. Zachariew's recent test reported in this issue of *Forestry Abstracts*, page 161). In recent years the so-called 'vital staining' and 'biochemical' methods have come into prominence.

The 'vital staining' methods are based on the ability of certain organic dyes to stain dead and dying plant tissues, without penetrating living tissues except after very long periods of soaking or in solutions of too high a concentration. Neljubow and subsequently Issatschenko, Shafer-Safonova and her colleagues, Krzeszkiewicz, Hao, and others tested seeds with many dyes including acid violet 6B, indigo carmine, nigrosine, fast red dyes, gentian violet, safranine, methylene green, methylene blue, methyl violet, and Bismarck brown. Indigo carmine in 1:1000 or 1:2000 solution was generally found to be best. The technique of the indigo carmine test as applied to Pine seeds is explained in the summary of Krzeszkiewicz's paper (cf. *Forestry Abstracts*, Vol. I, No. 2, pp. 87–8). Most investigators have worked with seed of *Pinus*, *Picea*, and *Abies* species, but the test has also been successfully applied to other forest tree species, e.g. Douglas Fir, Ash, Yellow Acacia, &c. Proper staining procedure and correlation between degree of staining and viability must be worked out for each species, but the variations are not very great. The test is inexpensive and very rapid, requiring only 6 hours in the case of Pine seed.

The 'biochemical' methods depend upon the ability of living cells through respiratory activity to reduce certain chemicals and to become distinctly coloured as a result of this process. These methods were inspired by Wieland's theory of respiration. Wieland maintained that hydrogen is the active element in respiration and that the oxygen molecule has the passive task of absorbing the hydrogen. To prove the hypothesis experimentally, oxygen had to be replaced by other 'hydrogen acceptors'. This was accomplished by Thunberg who, working on muscular tissues of frogs, replaced atmospheric oxygen by methyl blue which was reduced to methyl white through the respiration process in the cells. Turesson was the first to apply this method to viability determination in seeds. Gurewitsch elaborated a dependable and simple procedure for the testing of rye and wheat seeds with meta-dinitrobenzene. Eidmann tried in vain to apply Gurewitsch's test to forest tree seeds. Their embryos proved impenetrable to the nitrobenzene.

Meanwhile, Turina had introduced the use of selenious and telluric salts in plant physiology and

Hasegawa of the Asakowa Forest Experiment Station, Tokio, turned to sodium tellurate (Na_2TeO_4) for the testing of Japanese forest seeds. His technique consists in the following: the seeds are soaked in water for 24 hours at normal room temperature. Then the seed-coats are scratched or removed entirely. In the case of very large seeds the embryos may have to be excised at this stage. The seeds thus treated are placed in a Petri dish on paper soaked with sodium tellurate and another substance acting as catalyser. The seeds are then just covered with water. After 48 hours they are taken out of the dishes and the embryos are freed. The diagnosis is based on the intensity of colouring of the embryos. Embryos of an entirely black colour are capable of vigorous germination and most of them will grow to plants, those of a dull colour and spot-coloured embryos are unhealthy, and although they may be able to germinate they are incapable of forming plants, while uncoloured embryos can safely be assumed to be dead. The method is quick and simple. The sodium tellurate paper (patented by the Asakowa Research Station) can be transported easily without fear of deterioration through outside agencies. The following table, reprinted from Hasegawa's article in the *Japanese Journal of Botany*, shows that the results of his reagent method correspond closely to the germination percentage as obtained by sprouting. The mean value (M), its probable error (m), and the standard deviation (σ) have been calculated by the author on the basis of the determination of 60 sets of samples, each containing 400 seeds, in either method.

Species	*Percentage of sound Seeds tested by reagent method*		*Percentage of germination*	
	M±m	σ	M±m	σ
Pinus densiflora Sieb. et Zucc.	54·88±0·1718	±1·3304	55·27±0·2373	±1·8385
Larix kaempferi [Lamb.] Sargent	37·06±0·1868	±1·3856	37·41±0·2457	±1·8221
Thujopsis dolabrata Sieb. et Zucc.	24·22±0·1480	±1·1269	24·53±0·3104	±2·3643
Abies sachalinensis Mast.	8·68±0·1140	±0·8832	7·48±0·1770	±1·3712
Abies firma Sieb. et Zucc.	40·68±0·1924	±1·4900	42·52±0·3577	±2·7713

Eidmann applied Hasegawa's method to the testing of European forest seeds and found in the course of his experiments that he obtained better results with the much cheaper sodium biselenite ($NaHSeO_3$), which on liberation of free selenium gives a clear red and lasting colour, the shades of which are easier to distinguish. Embryos treated with sodium biselenite can be conserved in gelatine under glass without losing their original coloration and it is therefore possible to prepare control sets. The technique of Eidmann's method is described in detail in *Forestry Abstracts*, Vol. I, No. 1, p. 35. The test has the great advantage of giving a fairly reliable estimate of the 'plant potential', i.e. the plant percentage that will be obtained in the field. The utility of Eidmann's method was confirmed by Natlacen's experiments at Florence. The results of Natlacen's comparative tests on some 30,000 seeds are tabulated on page 121.

Hao, who tested large numbers of Douglas Fir, Pine, and Spruce seeds using Neljubow's indigo carmine and Eidmann's sodium biselenite methods, obtained satisfactory results from both, but he preferred the former method (cf. *Forestry Abstracts*, Vol. I, No. 2, p. 87). Tyszkiewicz points out that both methods, though quick and very valuable for the testing of slowly germinating and dormant seeds, have the great disadvantage of involving much more work than ordinary germination tests. For Pine and Spruce the testing of a lot of 400 seeds by the indigo carmine method requires about 8 times as much work as the germination test does. He therefore considers chemical methods uneconomical when applied to these two relatively easily germinable species and recommends the combined method as employed for Pine seed by the Warsaw Seed Testing Station. This method consists in submitting to the indigo carmine test all seed which has not germinated in ordinary apparatus within 5 days. The duration of the viability test is thus limited to a relatively short period and, at the same time, the number of embryos which remain to be excised is usually reduced to one-tenth or less as compared with Neljubow's unmodified procedure.

It may be noted in conclusion that all seeds hitherto tested by the 'vital staining' and 'biochemical' methods have been from temperate regions. The application of these methods to the testing of tropical forest tree seeds seems very promising and should yield useful results.

Species	*Germination percentage*	*'Germination potential'* [Eidmann]	*Plant percentage*	*'Plant potential'* [Eidmann]
Picea excelsa . .	40	43	19	20
	65	67	31	33
	85	83	42	44
Pinus sylvestris . .	60	61·3	28	29·6
	71	73	33·8	36
	85	86·7	42	41·6
Pinus austriaca . .	65	67·3	32	34
	80	83	40	43
	90	93	45	47·6
Pinus strobus . .	58	58·7	20	20·3
	70	70·3	25	25·6
	75	77	28	28·7
Larix europaea . .	23	24·4	14	16·2
	45	46	22	23·5
Abies pectinata . .	32	33·4	14	15·5
	46	47·3	18	19·0
	67	68·1	30	31·2
Pseudotsuga douglasii .	—	38·4	—	37·0
	—	46·7	—	44·2
	—	20·0	—	21·2
Acer campestre . .	87	87·4	29	30·3
Robinia pseudoacacia .	56	67·0	26	27·0

SELECTED REFERENCES

1. EIDMANN, F. E. Saatgutprüfung auf biochemischem Wege. [Biochemical method of seed testing.] *Z. Forst- u. Jagdw.* 68, 1936 [422–43]. German.
2. —— Die praktische Brauchbarkeit der Selenmethode bei der Saatgutprüfung. [The practical utility of the selenium method of seed testing.] *Deutsche Forstwirt* 20, 1938 [445–9; 457–60]. German.
3. FLEMION, F. A rapid method for determining the viability of dormant seeds. *Contrib. Boyce Thompson Inst.* 9, 1938 [339–51].
4. HAO, K. S. Über Saatgutprüfung auf biochemischem Wege. [On seed testing by biochemical methods.] *Z. Forst- u. Jagdw.* 71, 1939 [141–56; 187–204; 249–69]. German.
5. HASEGAWA, K. On a method of determining seed vitality by a certain reagent. *Japanese Journal of Botany* 8, 1936 [1–4].
6. KRZESZKIEWICZ, W. Określenie potencjalnej zdolności kielkowania nasion sosny za pomocá metody barwienia. [Determining the viability of Pine seeds by means of the indigo carmine colour test.] *Inst. Rech. For. Poland Trav. & Comptes Rendus* Ser. A, No. 44, 1939, pp. 45. Polish with German summary.
7. NATLACEN, G. I più recenti progressi nella determinazione della germinabilità dei semi forestali. [The more recent progress in the determination of the germination capacity of forest seeds.] *Alpe* 25, 1938 [16–20]. Italian.
8. NELJUBOW, D. [Presented by Issatschenko, B.] Über die Anwendung der 'Vitalfärbung' zur Bestimmung der Keimfähigkeit der Samen. [On the application of 'vital staining' to the determination of germination capacity of seeds.] *Actes du Vème Congrès International d'Essais de Semences.* Rome, 1929 [400–4]. German with English and French summaries.
9. ROHMEDER, E. Neuzeitliche Geräte und Arbeitsverfahren bei der Prüfung des Forstsaatgutes. [Modern apparatus and methods in the testing of forest seed.] *Forstwiss. Cbl.* 60, 1938 [218–31; 244–54; 265–78]. German.
10. SHAFER-SAFONOVA, E. Y. *et l.* Determination of the viability of forest tree seeds by the dyeing method. Part of a separate mimeograph publication of the *All-Union Scientific Research Institute for Silviculture and Rural Melioration with the Aid of Forestry* ['*Vnilami*']. Moscow, 1934. pp. 44. Russian. Summarized and reviewed in *Jnl. For.* 33, 1935 [640–1].
11. TYSZKIEWICZ, S. Über die Prüfung des Forstsaatgutes. [On the testing of forest seed.] *Forstwiss. Cbl.* 60, 1938 [725–38]. German.
12. ZACHARIEW, B. Ein bequemes Schnellkeimverfahren für Prüfung des Samens einiger Nadelholzarten. [A convenient process of rapid germination for testing the seed of certain conifers.] *Forstwiss. Cbl.* 61, 1939 [238–49; 281–93]. German.

Further references may be found in the bibliographies of 1, 3, and 6.

ABSTRACT SECTION

NOTE.—A capital letter in square brackets following the reference denotes the language in which the paper is written. A small letter denotes a summary in another or the same language, e.g. [G.e.]—German, with English summary. English [E.] is only indicated for papers published in journals usually written in foreign languages.

0. GENERAL FORESTRY

01. TERMINOLOGY. METHODS

01.2 (91). DESCH, H. E. **The use of the terms 'hardwoods' and 'softwoods' and some related problems.** *Malay. Forester* 8, 1939 (116–19).

01.3 : 01.4. DUNKLEY, H. L. **A multiple-entry perforated card-key for the identification of Uganda trees.** *Emp. For. J.* 18, 1939 (83–90).

The suitability of the perforated index-card system for botanical identification is discussed and a key of this type, for the trees and shrubs of Uganda, is described. Primarily, the key is intended for the field worker in the tropics, who is unlikely to have facilities for detailed dissection. Owing to its elasticity, and to the interchangeability of character sequence, the method has many advantages as an alternative to the ordinary dichotomous key. *Author's summary.*

04. PHOTOGRAPHS

04.5 (66.7). CANSDALE, G. S. **Infra-red films for tropical forest photography.** *Emp. For. J.* 18, 1939 (106–7).

05.3. *Annual Reports*

05.3 : 09.4 : 98 (54). GREAT BRITAIN. **Report on the work of the Indian Trade Commissioner during 1937–38.** Office of the High Commissioner for India, India House, Aldwych, London, W.C. 2. 1938. pp. 96.

05.3 (729). **Eighth annual report on Cacao research, 1938.** Govt. Printer, Govt. Printing Office, Port-of-Spain, Trinidad. 1939. pp. 42.

05.3 (74.7). TRYON, H. H. **The Black Rock Forest: ten-year progress report, 1928–1938.** *Black Rock For. Bull.* No. 10. Cornwall Press, Inc., Cornwall, New York. 1939. pp. 76.

07. EDUCATION. RESEARCH

07.2. KOSTLER, J. **The significance of the establishment of the International Forestry Centre [Centre International de Sylviculture].** *Holz* 2, 1939 (225–7). [G.]

An outline of the proposed organization.

07.2 (43). EBERTS, H. **The organization of forestry and timber research in Greater Germany.** *Holz* 2, 1939 (218–20). [G.g.]

07.2 : 3 (43). GLÄSER, H. **The work and aims of the 'Committee on the Technique of Forestry'** (ATF = Ausschuss für Technik in der Forstwissenschaft). *Holz* 2, 1939 (227–9). [G.]

07.2 (73). **Forest research in the United States.** National Research Council, U.S.A. 1938. pp. 138.

A critical review of the character and extent of the research work that has been done in all branches of forestry, with a view to determining the value of forest research in solving forestry problems in the United States.

07.2 : 24 : 12.25.53 (74). MOREY, H. F. **Research problems in the management of the Northern White Pine in the North-eastern United States.** *Ames For.* 27, 1939 (41–7).

An outline of the problems to be investigated in relation to forest management in the White Pine region.

07.2 : 99 (74.7). U.S.A. **Licensing of foresters: report of Committee on Licensing of Foresters, New York Section.** *J. For.* 37, 1939 (605–10).

07.2 (76). DEMMON, E. L. **Research results in Southern forestry.** *Southern Forest Exp. Sta. Occ. Pap.* No. 77. 1939. pp. 8. U.S.D.A. Forest Service.

Investigations undertaken at the Southern

Forest Experiment Station show that: (1) Stand improvement work can be profitable in second-growth stands of the Shortleaf-Loblolly-hardwood type. (2) Specific gravity is the best index of maturity of cones of the southern Pines, the test being floatability in a recognized grade of lubricating oil. (3) Storage of seed of Longleaf Pine can only be successful with low moisture-content of seed and low temperature. (4) Geographic source of seed is an important factor in the success of plantations. (5) The gum yield from Slash and Longleaf Pine increases with increased size and growth-rate of tree and there is close relation between grade of rosin and yield. (6) The removal of surrounding natural vegetation resulted in greatly increased growth of Longleaf Pine seedlings in plantations. A soil moisture-content of 25 to 30 per cent. is required for optimum growth of Longleaf and Slash Pine. (7) A close relationship has been determined between fire hazard and weather and fuel conditions. (8) In planting relatively poor sites for soil conservation, high-grade seedlings must be used; southern Pines should be planted in holes filled with topsoil; heavy grass should be ploughed away for Black Locust but not for Pines; broad-leaved planting stock should be heeled in on sand but not on loam; and large Black Locust plants can be used after heavy pruning of roots. (9) The yield of Black Locust seedlings is greatly increased by soaking the seed in concentrated sulphuric acid before planting. (10) In selective logging of second-growth Pine stands, using trucks and tractors, a cut as low as 500 board feet per acre is financially feasible, using the large logs for saw timber and the top logs for pulpwood.

09. FOREST STATISTICS. MONOGRAPHS ON INDIVIDUAL COUNTRIES AND FOREST REGIONS

09.4 : 09.7 (43). MANTEL. **The forests of Greater Germany.** *Tharandt. forstl. Jb.* 90, 1939 (304–7). [G.]

Statistical data on the forests of Germany brought up to date to 16th March 1939.

09.4 (43.47). WÜRTTEMBERG. **Forest statistical reports from Württemberg for the year 1937.** Printed for the Württembergische Forstdirektion by C. Schenfell, Stuttgart. pp. 108.

09.4 : 98.2 (44). GÉNEAU, G. **Sales of [French] timber during 1938.** *Rev. Eaux For.* 77, 1939 (496–514). [F.]

09.4 : 7 (489). GRØN, A. HOWARD. Dansk Skovbrugs Omsætningsbalance 1938–39. **[The economics of Danish forestry, 1938-39.]** *Dansk Skovforen. Tidsskr.* 1939 (275–99).

A statistical review of production, expenditure, and income. The figures are arranged by species [mainly Beech and Norway Spruce] and site-quality classes instead of by districts.

09.4 : 23.23.19 (71). LEGGATT, C. W. **Statistical aspects of seed analysis.** Department of Agriculture, Canada. *Bot. Rev.* 5, 1939 (505–29).

09.4 : 12.25.53 (72). MARTÍNEZ, J. G. **The exploitation of Pines in Mexico** [concld.]. **Statistics of resources, possible yields, production, and prices.** *Méx. for.* 17, 1938 (9–26). [Span. span.]

Twenty-six species of Pine are known to exist in Mexico. The total Pine area is estimated at 1,968,800 hectares with a standing volume of 429,906,400 cubic metres and an annual possible cut of 14,330,200 cubic metres. Only 1,791,300 cubic metres or 12·5 per cent. of the possibility were exploited in 1935, when the total value of the produce amounted to $30,058,000 Mexican.

09.4 (76). REYNOLDS, R. V., and PIERSON, A. H. **Forest products statistics of the Southern States.** *Statist. Bull. U.S. Dep. Agric.* No. 69. Supt. of Documents, Washington, D.C. 1939. pp. 106.

Statistics of lumber production, distribution, consumption and prices, pulpwood consumption and wood pulp and paper production, slack and tight cooperage stock, veneers, and turpentine and resin for Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, and Texas.

09.4 (77). REYNOLDS, R. V., and PIERSON, A. H. **Forest products statistics of the Lake States.** *Statist. Bull. U.S. Dep. Agric.* No. 68. Supt. of Documents, Washington, D.C. 1939. pp. 40.

Statistics on lumber production, distribution, consumption and prices, and on pulpwood, wood pulp, paper, slack cooperage, and veneer for Michigan, Minnesota, and Wisconsin.

09.4 (78). REYNOLDS, R. C., and PIERSON, A. H. **Statistics of forest products in the Rocky Mountain States.** *Statist. Bull. U.S. Dep.*

Agric. No. 64. Supt. of Documents, Washington, D.C. 1938. pp. 29.

Statistics on lumber production, distribution, consumption, and prices for Idaho, Montana, Wyoming, Utah, Colorado, Arizona, and New Mexico.

09.4 : 98 (79.5–7). JOHNSON, H. M. **Trends in lumber production in Oregon and Washington.** *J. For.* 37, 1939 (620–2).

With graphs showing the annual production in these states of Douglas Fir, Western Hemlock, Ponderosa Pine, Western Red Cedar, Sitka Spruce, and other softwoods.

09.7 : 09.4 (42). CHARD, J. S. R. **Census of woodlands [1938] of the United Kingdom.** *Emp. For. J.* 18, 1939 (58–60).

The results so far obtained from this census indicate that in general the private woodlands of the United Kingdom are in poor condition and suffering from lack of proper management, and that plantations, often of unsuitable species, are not receiving the necessary attention after establishment.

09.7 (42.61). MACDONALD, J. **Thetford Chase, with notes on Swaffham Forest and the King's Forest.** *Forestry* 13, 1939 (1–18).

These forests are located in the south-west of Norfolk and extend into Suffolk. The Forest of Thetford covers an area of about 44,000 acres. The topography of this region is gently rolling and of low elevation. The soils are sandy and underlain with chalk. The severity of the climate is a factor which limits the range of species to be used in afforestation. In the past the land was open to a great extent, though shelterbelts and hedges, mainly of Scots Pine, were established as enclosures of agricultural plots, and later mixed coniferous belts and coverts were planted by sporting interests. Measurements indicate that quality-class 2 is the average for Scots Pine in this district, and that the majority of Corsican Pine are in quality-class 1.

In recent plantings a number of species including Scots Pine, Corsican Pine, Douglas Fir, Beech, and Oak have been used. The Pine have been most successful, though other species have been established on the better sites. Scots Pine is useful as a nurse species for Douglas Fir and Oak.

The protection of these forests from fire, insects, animals, and fungi is discussed. A system of five lookout towers has been established as a protective measure against fire. The Pine Shoot Moth [*Evetria buoliana*] is a serious pest in the Scots Pine plantations, with the result that a high proportion of Corsican Pine is being used at present.

The thinning treatment being applied to young plantations is (*a*) a pre-thinning or removal of the worst wolf trees from stands 12 to 14 ft. high, and (*b*) the marking of 250–350 selected stems per acre and the thinning out of all dominant and co-dominant trees that are interfering with their growth. Small, inferior stems are left to die.

09.7 : 91 (488.7). JANSSON, A. Virkes- och arbetstillgången inom Västerbotten läns lappmark: något om verkningarna av 1932 års skogsvårdslag. [**Timber and labour resources in the 'Lappmark' of Västerbotten: notes on the effects of the Forest Conservation Law of 1932.**] *Skogen* 26, 1939 (247–52, 271–2). [Sw.]

The chief aim of the law of 1932, which came into operation in January 1934, was to secure the speedy removal of a large stocking of damaged, over-mature, and mature timber, amounting to 63 per cent. of the timber over 10 cm. d.b.h. in the Pine-Spruce forests of Västerbotten. If cuttings go according to plan, the outturn will gradually decrease and remain for a period at a low level before the forests are fit to work on the basis of sustained yield. The progressive reduction of fellings will restrict opportunities for work, but since forestry is only a part-time occupation for many of the inhabitants, it is possible that the situation may be relieved by the development of other pursuits.

09.7 : 07.8 (54.5). WRIGHT, H. L. **Forestry beyond the Indus.** *Indian For.* 65, 1939 (251–4, 311–14, 389–93, 467–71).

Valuable forests in the hills beyond the north-west frontier of British India cover the catchment areas of many rivers on which the water supply of India is dependent. These forests are on tribal territory and, apart from settled areas, are gradually coming under the supervision of the Forest Service.

The composition and past history of the forests of two of these territories—Chitral State and the Kohistan of Swat—are described briefly. The forests of both regions are nearly pure Deodar (*Cedrus deodara*). Chitral State is the northern limit of Deodar and is in a dry zone.

It is a mountainous country, drained by the Kunhar river, and is the most northern contact for the Forest Service of India. The 'Kohistan' are the upper highlands of the Swat river valley as contrasted with the lowlands. During the spring and winter there is a fairly heavy precipitation. The exploitable forests of this region are managed under a selection system and all other forests are included in a protection circle.

The forests of the Gilgit Agency in North-west Kashmir are also discussed. Here annual precipitation is only 5 or 6 in. and the forests are mainly in scattered pockets. They have no commercial importance, but their proper management is necessary to maintain local supplies of timber and fuelwood. Commercial species grow only at high elevations—Spruce at 9,000 ft. and Blue Pine even higher. Above the conifers are to be found broad-leaved species as Birch, Willow, Poplar, and Mountain Ash.

09.7 : 23.11 : 12.28.47 (54.7). DHARESHWAR, S. S. **Honavar Range and Teak regeneration.** *Indian For.* 65, 1939 (406–24).

The forests of the Honavar Range in the Western Forest Division, Kanora, cover an area of approximately 184 square miles. They may be classified into: (*a*) pure evergreen climax forest type, (*b*) proclimax mixed deciduous forest, merging into semi-evergreen, in which patches of Teak occur, and (*c*) scrub forest—a degraded relic of a forest of quality similar to (*b*).

A portion of the reserve forest has been organized under four different working plans, the most important of which is the Working Plan for the Below Ghat Inland Forests which is concerned with the management of nearly 38 square miles of the moist deciduous forest. This plan was introduced in 1928 and its object is to convert the forest into a timber-producing, Teak-bearing, deciduous mixture with at least 50 per cent. Teak. The prescribed treatment is clear felling with artificial regeneration of Teak. Two methods of applying this treatment are described and the results compared. First the agri-*cum*-forestry method of combining regeneration of Teak with the cultivation of *ragé* after clear cutting and heavy burning, as done in the past by local shifting cultivators, and second, the method of clear cutting followed by light to moderate burning and planting of Teak. The results indicate that the first method is superior, particularly where the forest tends towards the evergreen climax, as the heavy burning completely eradicates inferior species of the previous stand and destroys the thick humus layer and soil acidity. Furthermore, the crop of *ragé* controls run-off during heavy rains and the stalks of this crop improve soil conditions.

Measurements over a period of 20 years of average plantation crops of Teak, established by these two methods, indicate that the agri-*cum*-forestry method of the shifting cultivators results in greater increment of Teak, both by height and by diameter. It also appears that 9 ft. × 9 ft. is the best spacing for Teak plantations in this region.

09.7 (57.1). KRASNOV, M. I. **Forestry in Kamchatka.** *Lesnoe Khozyaystvo, Moscow* 7, 1939 (49–52). [R.]

Report on linear valuation surveys in the Kamchatka Valley, eastern Siberia. Of the 1,645,000 hectares of forest land, about 1,000,000 hectares (60·7 per cent.) bear Larch and 455,000 hectares (27·6 per cent.) are growing Birch. The forests still await their rational exploitation. One of the main problems to be faced is the reconciliation of timber floating with the requirements of the highly developed fishing industry.

09.7 (66.8). AUBRÉVILLE, A. **The forests of Dahomey and Togo.** *Bull. Com. A.O.F.* 20, 1937 (1–112). [F.]

09.7 (67). AUBRÉVILLE, A. **Relic forests in French West Africa.** *Rev. Bot. appl.* 19, 215, 1939 (479–84). [F.]

Mainly on formations of Kololo (a *Cynometra* species). A description of *Acacia boboensis* Aubréville is included.

09.7 : 90 (68.9). S. RHODESIA. **Report of Commission to enquire into the Preservation, etc. of the Natural Resources of the Colony:** presented to the Legislative Assembly, 1939. Govt. Stationery Office, Salisbury, S. Rhodesia. 1939. pp. 76.

09.7 : 12.19 (71:2). GILL, C. B. **The development of forestry in Manitoba.** *Emp. For. J.* 18, 1939 (30–43).

The Province of Manitoba extends 761 miles north from the centre of the North American continent. The vegetation changes with latitude and beginning in the south and going north there are belts of varying width of (*a*) Grassland, (*b*) Aspen Grove, (*c*) Boreal Forest, (*d*) Northern Transition Belt, and (*e*) Tundra.

The most important timber trees are White Spruce, Black Spruce, Jack Pine, Tamarack (*Larix laricina*), Balsam Fir, White Birch, Aspen, and Balsam Poplar. Most of the forested land is retained by the Crown, licences being granted for the cutting of timber and pulpwood. The historical development of the province is outlined and the various factors that have contributed to the present forest policy and organization are discussed. These include forest reservations and stock-taking surveys, timber and pulpwood licensing, fire protection, utilization, and forest management. The extension of reserved areas and the application of sustained yield management to all Forest Reserves are projected in the present policy of the Forest Service.

09.7 (72). QUEVEDO, M. A. DE. **Report on the principal works carried out by the [Mexican] Department of Forests, Game, and Fisheries from its creation in Jan. 1935 to the end of 1938.** *Méx. for.* 17, 1939 (3–8). [Span.]

09.7 (729.12). SWABEY, C. **Forestry in Jamaica.** *Emp. For. J.* 18, 1939 (19–29).

A brief outline of the history of the island and a general description of the principle ecological factors and particularly the four main topographic features—the interior mountains, the elevated limestone plateau, the coastal mountains, and the coastal plains—with lists of the typical tree species found in each region.

The policy of the Forestry Branch is being developed with particular attention to two main problems, (1) the protective value of forests in soil conservation, (2) control of forest exploitation with better utilization of local timber. A ten-point programme to implement this policy is outlined.

09.7 : 3 (729.4). HERAUX, G. **Forests and timbers of Haiti.** *Rev. int. Bois.* 6, 1939 (163–71). [F.]

Notes on forest distribution, composition, and utilization and on the xerophilous vegetation of Haiti.

09.7 : 12.27–8 (729.5). HOLDRIDGE, L. R. **Some notes on the Mangrove swamps of Puerto Rico.** U.S. Forest Service. 1938. pp. 10.

The habitat, growth and ecological characteristics, wood properties and uses, natural and artificial regeneration, and growth of four species of Mangroves are discussed. Natural conditions that do not favour regeneration of these species are described.

09.7 : 09.4 (76.3). WINTERS, R. K., PUTNAM, J. A., and ELDREDGE, I. F. **Forest resources of the North-Louisiana Delta.** *Misc. Publ. U.S. Dep. Agric.* No. 309, Supt. of Documents, Washington, D.C. 1938. pp. 48.

A description of the region and forest conditions with detailed data on the present timber stand, rate of growth, and utilization of forest products.

09.7 : 12.19 : 23.3 : 43.1 (922.3). SWART, F. **The Wilis Mountains in the Kediri Division, Dutch East Indies: natural vegetation and afforestation.** *Tectona* 32, 1939 (469–508). [Du. du. g.]

Plantations of fire-resistant species are laid out in such a manner as to break the continuity of areas bearing easily inflammable vegetation of grasses and sparse Tjemara trees (*Casuarina junghuhniana* Miq.) This vegetation covers all the higher elevations and is itself a result of continual fires due in the first instance to volcanic activity and later, to human agency.

09.7 (94 : 931). KLEMME, M. **Forestry in Australia and New Zealand.** *J. For.* 37, 1939 (632–4).

From information obtained while making a tour of these countries to study grazing and forestry conditions.

1. FUNDAMENTAL NATURAL LAWS OF THE FOREST

11.1. *Atmosphere*

11.11.2 : 11.42.3 : 11.41.33 : 12.25.52. PRIEHÄUSSER, G. **Ground frost, soil development, and shallow-rootedness of Spruce.** *Forstwiss. Cbl.* 61, 1939 (329–42, 381–9). [G.]

The author discusses the distribution of ground frost in Spruce stands and stresses the important relation between soil moisture resulting from thawing and podsolization. By increasing this latter condition, ground frost indirectly contributes to shallow-rootedness.

11.11.4 : 11.41.33. GEIGER, R. **On dry periods during the summer: the meteorology of dry periods in relation to the**

supply of water in the soil. *Forstarchiv* 15, 1939 (227–34). [G.g.]

Data collected at Eberswalde during 8 years show that from the very beginning of dry periods the relation between the decrease in the water reserve of the soil and the duration of such periods is that of a decreasing proportion. The daily decrease is greatest at the beginning of a dry period and gradually diminishes. The non-replenishment of water reserves during a period of 'normal' water requirements results in drought damage.

11.11.4 : 12.25.53 (77.6). SCHANTZ-HANSEN, T., and JORANSON, P. N. **Some effects of the 1936 drought on the forest at the Cloquet Forest Experiment Station.** *J. For.* 37, 1939 (635–9). [University of Minnesota.]

The differences between the average surface areas of the needles of Jack Pine, Red Pine, and Northern White Pine produced in the drought year 1936 and those produced during the more normal growing season of 1935 were, without exception, found to be highly significant. In a stand of Red and Northern White Pine ranging from 30 to 40 ft. in height and located on a thin soil underlain by rock, approximately half of the total number of trees and nearly all of the Red Pines were killed. *From author's summary.*

11.12.4. WOELFLE, M. **Wind conditions in the forest: Pt. II. Wind velocities over the marginal zone of the stand.** *Forstwiss. Cbl.* 61, 1939 (461–75). [G.]

In an experiment at Pentenried, near Munich, it was found that wind velocity in gaps in the lateral canopy of forest margins ('Bestandsmantel') was even higher than in the open field. It is therefore essential that the lateral canopy should reach down to the soil wherever there is danger from desiccation.

11.12.4 : 21.7 (74). BROMLEY, S. W. **Factors influencing tree destruction during the New England hurricane.** *Science* 90, 1939 (15–16).

Factors suggested as contributing to the relatively high tree destruction by the New England hurricane of 1938, as compared with the hurricane damage in the Southern States, are—(1) local wind gusts of extremely high velocity, (2) tree species of relatively low gale resistance such as White Pine, Norway Spruce, Willows, Poplars, Locusts, and Soft Maple, (3) many trees and stands in the stage of development when they are most susceptible to wind damage—at 30 to 100 years, (4) man-made conditions as regards both shade trees and timber stands, (5) the weakened condition of many trees due to insect and fungus infestations prior to the hurricane, and (6) soil conditions unfavourable to root development and anchorage.

11.16.22. MOORHOUSE, S. **Trees and lightning.** *Wood* 4, 1939 (299–300).

Records over a number of years taken in both England and France indicate that susceptibility to damage by lightning varies with species, Oak and other rough-barked species as Elm, Chestnut, and Pine having a relatively high susceptibility, whereas Beech and Birch are seldom, if ever, struck.

11.2. *Climate*

11.21.1 : 42.3–4 : 96 : 97.1 (66). JONES, B. **Desiccation and the West African Colonies.** *Repr.* from *Geogr. J.* 91, 1938 (401–23).

Since the beginning of the Quaternary period the climate of West Africa has changed several times, the most recent change having been towards greater moisture. During historic times, however, the climate has been stable except for minor fluctuations, and it is impossible to say whether any major change is now taking place. Silting and river capture are reducing the amount of surface water carried into the regions fringing the desert, but this process is too slow to be of immediate importance and may be retarded by flood control and the protection of headwaters. Ground water, the main source of water on the fringes of the Sahara, shows no sign of depletion. The slow changes in the extent of the Sahara that accompanied the major climatic changes are no longer to be demonstrated and the Sahara cannot be said to be encroaching upon the West African colonies. Thus a great shelterbelt is unnecessary, and in any case a natural barrier already exists in the thorn forest of Northern Nigeria, which requires little protection, since damage from man is not serious on account of its unsuitability for agriculture. Local sand drift on farms can be corrected by improved farming practice. The most severe erosion could be checked by the protection of forests along streams and in headwaters; in other places the flat topography and porous soil tend to check the more serious forms of erosion. Except when interfered with, the natural forests are stable. The most severe damage to them is done, not by herds or fire, but by shifting

cultivation, which threatens to destroy the forest cover if allowed to continue unchecked. The forest should b reserved and protected where serious damag is likely to occur, and fixed farming should encouraged. Only in very sandy districts, where fixed farming is difficult because of the infertility of the soil, should shifting cultivation remain, and even in such places it should be restricted so far as possible.

11.21.1 (73). **Some American papers and notes on climatic variations:** report of the American Committee of the International Commission of Climatic Variations to the International Geographical Congress, Amsterdam, Holland, July 1938. *Bull. Amer. met. Soc.* 19. The American Meteorological Society, Milton, Massachusetts. 1938. pp. 64.

11.21.5 : 43.1 (71). BEALL, H. W. **Forecasting weather and forest-fire hazard from local observations.** Dominion Forest Service, Ottawa. 1937. pp. 43.

11.4. *Soil*

11.4 : 01.3. VILLAR, E. H. DEL. **A new contribution to a universal objective classification of soils.** *Soil Research* 6, 1939 (221–6). [E.f.]

11.4 [499.8]. NEVROS, K., and ZVORYKIN, I. **The soils of the island of Crete.** *Soil Research* 6, 1939 (242–308). [G.e.]

11.4 : 12.25.51–3–7 (54.6). HOON, R. C. **A study of the soils in the hill areas of Kashmir: an investigation of soil profiles under Deodar, Blue Pine, Silver Fir, and Chir.** *Indian For. Rec.* [*n.s.*] *Silviculture* 3 (6), 1939 (195–261).

The soils found under Blue Pine (*Pinus excelsa*) in the Kashmir valley are derived from the *Karewas* lacustrine deposits; they appear to be impermeable and stiff, are predominantly silt and clay, free from boulders, fairly deep, and belong to either the brown earth group or immature podsols. The peat layer, when present, is unfavourable to Blue Pine regeneration. Soils of typical Deodar (*Cedrus deodara*) areas in this valley are derived from the Panjal traps. They are well drained and workable, having a fair distribution of sand, clay, and silt, and contain stones of various sizes. They belong to the podsol group. The soils under Silver Fir (*Abies pindrow*) in the valley are also derived from *Karewas*. They are heavy and often waterlogged, resulting in a gley soil. Low pH values and exchangeable calcium content are characteristic. Soils of typical Chir (*Pinus longifolia*) areas were obtained from the Batote range. They are derived from the Murree Series, have fairly high silt and clay content, and contain undecomposed boulders throughout the profile.

11.41. Soil physics

11.41.1 : 07.7. GOODELL, B. C. **A soil-boring tool for frost-depth determination.** *J. For.* 37, 1939 (457–9).

Made of steel tubing with a threaded cutting tip. A ramrod is used to eject the core for measurement. Illustration, plan, and specification are included.

11.41.1 : 07.7. ISAAC, L. A. **The use of 'Gooseneck' and Six's thermometers for measuring soil temperature.** *J. For.* 37, 1939 (421–3).

A bench tool-grinder adapted for centrifuging the mercury in a gooseneck maximum thermometer from a high reading to the current temperature; also a protective box for fragile Six's thermometers used in taking sub-surface soil temperatures.

11.41.11 : 11.46 (77). GOODELL, B. C. **Soil freezing as affected by vegetation and slope aspect.** *J. For.* 37, 1939 (626–9). [Central States Forest Exp. Sta.]

In measuring depth of freeze in soils of paired sites in which soil, slope, and aspect were similar and vegetation cover varied, it was found that freezing occurred frequently and to an appreciable depth in pasture and crop land soils during weather which produced no freezing in comparable forest-covered soils. The maximum measured depth of freeze in pasture soils was 1·5 in. and in corn-field soil was about 5·5 in. Freezing was considerably deeper on a north-facing pasture slope than on a comparable southern slope.

11.41.33 : 11.41.4–5 : 07.7 (74·7) WALLIHAN, E. F. **Use of tensiometers for soil moisture measurement in ecological research.** *Ecology* 20, 1939 (403–12). [Cornell University, Ithaca, New York.]

This instrument measures the capillary tension of the soil water over a range of from zero to 65 cm. of mercury. In principle a porous vessel is buried in the soil to the desired depth

and connected by means of copper tubing with an indicating instrument. The whole system is filled with water and sealed, and changes in the capillary tension of the soil water affect the tension of water in the system, which in turn reacts on the indicator. These instruments measure the force with which water is being held by the soil without reference to the nature of the soil, and the readings can be converted into percentage of soil moisture by proper calibration. The apparatus gives continuous readings without disturbance of the soil after installation. Readings of two adjacent tensiometer cups give a measurement of the direction and magnitude of the capillary gradient. The use of manometers limits the range to one atmosphere of tension, which represents a soil moisture range from saturation to a point somewhat below the moisture equivalent. The conducting system of a tensiometer must be kept absolutely air-tight and free from gas pockets, and in cold climates the porous vessels should be removed from the ground at the end of the growing season. *From author's summary.*

11.41.33 : 23.1 : 12.25.53. BENINDE, R. **The water factor in the management of natural regeneration of Pine.** *Z. Forst- u. Jagdw.* 71, 1939 (217–31). [G.]

Mosses tend to counteract gravitational losses of moisture in very sandy soils and thus favour Pine regeneration in such soils.

11.41.7. CHATTERJEE, B., and DAS, B. K. **Sodium ferrocyanide as dispersing agent in mechanical analysis of soils.** *Soil Research* 6, 1939 (227–31).

The soil is treated with 6 per cent. H_2O_2 for removing organic matter, leached with N-NaCl, washed twice with 100 cc. of 0·01 N-NaCl and with distilled water. Soil is then dispersed in dilute (0·002M) $Na_4Fe\,[CN]_6$ by shaking and sampled by pipette.

11.41.7 : 11.41.6. GRAČININ, M. **The classification of soils according to texture.** *Ann. Exp. for., Zagreb* 6, 1938 (390–404). [Serb. g.] Štamparija Gutenberg, Zagreb, Jugoslavia.

A criticism of Kopecky's simplified classification. A new system is suggested, which includes 11 categories.

11.42. Soil chemistry

11.42.3 : 11.44.2. GLØMME, H. Råhumus [**Raw humus**]. *Tidsskr. Skogbr.* 47, 1939 (259–67). [Nor.]

A general account of the nature and formation of mors.

11.42.31 : 23.1 : 12.25.55 (77.2). POTZGER, J. E., and FRIESNER, R. C. **Soil acidity and Hemlock reproduction in relic colonies in Indiana.** *Repr.* from *Proc. Ind. Acad. Sci.* 46, 1937 (93–9).

Soil acidity appears to be a significant factor in Hemlock reproduction in Indiana, the optimum pH range for Hemlock seedlings being 4·7 to 5·5. In general, soil bearing Hemlock is more acid than that bearing deciduous forest.

11.43. Biology of Soil

11.43. ROMELL, L. G. Barrskogens marksvampar och deras roll i skogens liv. [**Soil fungi of coniferous forest and their role in the forest's life.**] *Svenska SkogsvFören. Tidskr.* 37, 1939 (348–75). [Sw.e.]

Essentially a semi-popular critical review of present-day knowledge on the subject, with special reference to the mycorrhiza problem, and to field observations rather than laboratory experiment. The paper includes a detailed bibliography.

11.43.1. BUTLER, E. J. **The occurrences and systematic position of the vesicular-arbuscular type of mycorrhizal fungi.** *Trans. Brit. mycol. Soc.* 12, 1939 (274–301).

11.43.1. RAYNER, M. C. **The mycorrhizal habit in relation to forestry: III. Organic composts and the growth of young trees.** *Forestry* 13, 1939 (19–35).

Past observations have indicated that poor growth response of tree seedlings in certain soils was concerned with the production of inimical by-products through biological activity rather than lack of available nutrients, and that improved growth and vigour, following the addition of composts to such soils, were due not so much to the increase of mineral nutrients supplied by the composts, as to 'qualitative changes in the humus constituents'. The present experiment was undertaken to obtain direct evidence in this regard. Pot cultures of Scots Pine were grown in two series, each of 8 cultures, one series in which drainage water was returned to the cultures and one in which it was not. The list of experimental series and the results of the various soil treatments is contained in Table I, taken from the more comprehensive tables in the original text. The measurements on which these figures are based were made 18 months

after the seed was sown. While the addition of available nutrients as inorganic salts, in amounts equivalent to that contained in organic composts, increased plant growth as compared with untreated soil, this treatment was not nearly as effective as the addition of organic composts. Furthermore, it will be noted that in Series 1, 3, 5, 7, and 8 the return of drainage water to the culture was detrimental to plant growth, thus indicating the presence of substances in the experimental soil that are actively deleterious. The addition of organic composts in Series 2 and 4 put an end to the effectiveness of such substances.

TABLE I

Series	Treatment	Mean weight per 100 plants					
		Group I. Drainage returned			Group II. Drainage not returned		
1	Control	Shoots	13·36	19·90	21·34	29·52	
		Roots	6·54		8·18		
2	+C_8 Compost	Shoots	129·00	171·76	121·09	156·67	
		Roots	42·76		35·58		
3	+C_8 Salts	Shoots	50·32	70·56	67·87	92·49	
		Roots	20·24		24·62		
4	+C_1 Compost	Shoots	84·06	113·75	83·46	108·13	
		Roots	29·69		24·67		
5	+C_1 Salts	Shoots	22·59	32·55	31·05	44·24	
		Roots	9·96		13.19		
6	+Cow Manure	Shoots	94·54	129·29	92·84	126·43	
		Roots	34·75		33·59		
7	+C_8 Extract	Shoots	21·62	32·04	32·63	45·35	
		Roots	10·42		12·72		
8	+C_1 Extract	Shoots	14·20	20·20	29·03	39·82	
		Roots	6·00		10·79		

C_8 is a compost made from hop waste with the addition of 1 per cent. nitrogen in the form of dried blood, and C_1 is made from chopped wheat or oat straw with sufficient water to consolidate it.

11.43.1 : 12.11.2 : 12.21. MAGROU, J. Nouveaux essais de culture des champignons de mycorhizes [**New cultural experiments with mycorrhizal fungi**]. *C. R. Acad. Sci. Paris* 208, 1939 (935–5). R.A.M. 18 (470).

Improved development of mycorrhizal fungi in culture was secured by the provision of aneurin.

11.43.1 : 12.11.2. MELIN, E., and LINDBERG, G. Über den Einfluss von Aneurin und Biotin auf das Wachstum einiger Mykorrhizenpilze. Vorläufige Mitteilung. [**On the influence of aneurin and biotin on the growth of some mycorrhizal fungi. Preliminary note.**] *Bot. Notiser* 1939 (241–5).

11.43.1 : 12.25.52–3 : 12.21 (485). MODESS, O. Experimentelle Untersuchungen über Hymenomyceten und Gasteromyceten als Mycorrhizabildner bei Kiefer und Fichte (Vorläufige Mitteilung). [**Experimental studies in Hymenomycetes and Gasteromycetes as mycorrhiza-producers on Pine and Spruce (Preliminary note).**] *Svensk bot. Tidskr.* 33, 1939 (91–3). R.A.M. 18 (541–2).

In experiments at the Botanical Laboratory, Uppsala, Sweden, on mycorrhizal synthesis between about 50 Hymeno- and Gasteromycetes, and seedlings of Pine (*Pinus sylvestris* and *P. montana*) and Spruce (*Picea abies*), in pure culture, using Melin's technique, mycorrhiza were formed by *Amanita mappa* on all three hosts, *A. muscaria umbrina* on all, *A. pantherina* on all, *A. rubescens* on *Pinus montana*, *Boletus flavidus* on all, *B. subtomentosus* on *P. montana*, *Clitopilus prunulus* and *Entoloma rhodopolium* on *P. sylvestris*, *Lactarius helvus* on all, *L. rufus* on *P. montana*, *Tricholoma albobrunneum*, *T. imbricatum*, and *T. pessundatum* on all, *T. vaccinum* and *Rhizopogon luteolus* on *P. sylvestris*, and *R. roseolus* on *P. sylvestris* and *P. montana*.

11.43.1 : 12.2. KELLEY, A. P. **The occurrence of mycorrhizae considered systematically with special reference to the extent of our knowledge concerning them.**

Landenberg Laboratory, Landenberg, Pennsylvania. 1938. pp. 12.

The families of the Angiosperms, Gymnosperms, and Pteridophytes are listed with the number of species in each family, the number of species that have been reported as mycorrhizal, and the number that have been verified as such. Twenty-seven species of Apetalae, 48 species of Apopetalae, 26 species of Gamopetalae, 11 species of Monocotyledons, 25 species of Gymnosperms, and 8 species of Pteridophytes have been definitely established as mycorrhizal.

11.43.1 : 12.25.52. LINDQUIST, B. Die Fichtenmykorrhiza im Lichte der modernen Wuchsstoffforschung. [**Spruce mycorrhiza in the light of modern growth-substance research.**] *Bot. Notiser* 1939 (314–55). R.A.M. 18 (608–9).

A full account of the author's experiments on the effect of extracts from pure cultures of mycorrhiza-forming and other soil fungi on Spruce seedlings grown in Erlenmeyer flasks on sand with the addition of a synthetic solution. Seedling growth was stimulated only by the secretions of two unnamed mycelia and by that of *Mycelium radicis nigrostrigosum*. Growth was retarded by the secretions of the parasitic soil fungi *M. r. atrovirens*, by a Danish strain of *Mucor ramannianus*, and by another unnamed mycelium. Yet another unnamed fungus had no demonstrable effect on the seedlings. The paper concludes with a critical discussion of the various theories advanced in explanation of the mycorrhizal phenomenon.

11.43.1 : 12.27.49. MALAN, C. E. Ricerche sui tubercoli radicoli e sulle micorize delle Leguminose alpine. [**Researches on the root tubercles and mycorrhiza of Alpine legumes.**] *Ann. Bot., Roma* 21, 1938 (465–94). R.A.M. 18 (470–1).

A study of the mycorrhiza of leguminous herbs growing in Alpine Beech and Larch forests, forest glades, and pastures. In all the *Leguminosae* studied endotrophic mycorrhiza with hyphae of the Phycomycetoid type predominated. Numerous observations showed that the mycorrhiza never come into contact with the nitrogen nodules or with parts of the root in close proximity to them.

11.44. Soil cover

11.44.2. BUCK, C. C., and HUGHES, J. E. **The solvent distillation method for determining the moisture content of forest litter.** *J. For.* 37, 1939 (645–51). [California Forest and Range Exp. Sta.]

A sample of material to be analysed, of sufficient size to yield at least 3 ml. of water, is distilled in an extraction flask with some solvent that is immiscible with water, such as xylene. Water and solvent vapours are condensed and collected in receivers graduated to 0·1 ml., where the water, with a relatively high specific gravity, sinks to the bottom and forms a measurable layer. The clear solvent at the top is allowed to run back to the flask and repeat the process. The volume of water is measured at the meniscus between the water and solvent and is corrected for any variation from the standard boiling temperature of the solvent, which, in the case of xylene, has been accepted as 139° C. The volume of water obtained is subtracted from the original wet volume of the sample and this difference divided into the water volume to give the indicated moisture content. The distillation period to be used, in this case 1 hour, would vary with the solvent.

11.44.2 (79.4). KITTREDGE, J. **The annual accumulation and creep of litter and other surface materials in the chaparral of the San Gabriel Mountains, California.** *Repr.* from *J. agric. Res.* 58, 1939 (537–41).

A study of annual litter accumulation, leaf fall, total forest floor, and surface creep based on samples from trays distributed mechanically over two canyons, one of which had been burned over 16 to 18 years previously, and the other having been undisturbed for more than 50 years. Measurements were taken in the years 1935, 1936, and 1937 for the different vegetational communities within the chaparral forest.

11.45. Geological conditions

11.45 (67.8). WILLIAMS, G. J., and EADES, N. W. **Explanation of the geology of Degree Sheet No. 18 [Shinyanga].** *Tanganyika Territory, Dep. Lands and Mines Geol. Divn., Bull.* No. 13. Govt. Printer, Dar es Salaam. 1939. pp. 20.

11.46. Relationship of plants to the soil

11.46.2 : 56.14 : 12.27.49. ROBERTS, E. G. **Soil depth and height growth of Black Locust.** *J. For.* 37, 1939 (583–4).

From a study made three years after planting Black Locust on upland sandy loams underlain by sandy clay or clay, it was determined that the height growth of the Black Locust increased with increase in depth of surface soil.

11.47. Maintenance of favourable soil conditions

11.47 : 23.2. OUDIN, A. **Fertilizers and measures for soil improvement in reforestation work.** *Rev. Eaux For.* 77, 1939 (335–41). [F.f.]

The subject is discussed in relation to plantations with more or less degraded soils, brown forest soils, and endodynamomorphic soils.

11.47.1 : 12.25.5 : 23.26. LARSEN, J. A., and STUMP, W. G. **Some experiments with fertilizers for evergreen seedlings.** *Iowa St. Coll. J. Sci.* 13, 1939 (293–311). [Forestry Dep., Iowa State College.]

Nursery and greenhouse experiments with various fertilizers on the production of seedlings of White Pine, Douglas Fir, and Norway Spruce.

11.47.13. JESSEN, W. Kalium- und Magnesiummangelerscheinungen und Wirkung einer Düngung mit Kaliumchlorid und Kalimagnesia auf das Wachstum verschiedener Holzarten. **[Symptoms of potassium and magnesium deficiencies in, and the effect of manuring with potassium chloride and sulphate of potash magnesia on the growth of different varieties of forest trees.]** *Ernähr. Pfl.* 35, 1939 (228–30). [G.e.] O.R.E.

Seedlings of Larch, Fir, and Spruce were grown on Dörentrup quartz sand pre-treated with hot 10 per cent. hydrochloric acid to remove any nutrients present. Seven treatments were included in the experiment: (1) no fertilizer, (2) manuring without potash, (3) complete fertilizer with low potash application as KCl, (4) complete fertilizer with triple potash application as $(KCl)_3$, (5) complete fertilizer with low application of potash magnesia (KMg), (6) complete fertilizer with triple application of potash magnesia $(KMg)_3$, (7) manuring without magnesia.

Nutrients were applied in solution. Fir and Spruce seedlings receiving no potash showed a chlorotic discolouring of the needles and retardation in growth within 3 months of seeding. In 5 months the needles of the Larch began to yellow and the Spruce and Fir seedlings showed brown and reddish purple discoloration. Spruce and Fir seedlings receiving no magnesium gave indications of this deficiency towards the end of the growing season, the needles first turning yellow and then reddish brown at the tips. Applications of potash in both forms resulted in considerable increases in yields of dry matter.

11.47.13.2 : 12.25.53 (941). PERRY, D. H. **The effect of superphosphate on *Pinus pinaster*.** *Aust. For.* 4, 1939 (12–14).

The seedlings of *Pinus pinaster* have difficulty in becoming established and show very poor growth on the deep, coarse, nutrient-deficient sands on the coast of Western Australia. It has been determined that the application of 2 oz. of superphosphate per tree to the surface of the soil as near the tree as possible, probably every 3 years for the first 15 years, will ensure normal development, and when applied to stagnated trees will restore them to normal appearance within 2 years. Applications should be made near the beginning of the growing season. It has been determined that the water-soluble phosphate is the stimulating element in this fertilizer.

11.48. Kinds of soil

11.48 (54.87). ROSAYRO, R. A. DE. **Soils of the wet-zone forests of the Matara, Galle, and Kalutara Districts [Ceylon].** *Repr.* from *Trop. Agriculturist* 92, 1939 (264–78).

The study of the profile characteristics of the Wet Zone forest soils indicates that a relationship between purely physical characters of the soils and the site-conditions, as reflected in the dominant tree height growth, may be established; and on this basis the Wet Zone forest soils have been classified into seven groups. Well-defined characteristics of the soils of Group I, II, and III have been related with the distribution and predominance of the tree species Hora (*Dipterocarpus zeylanicus*) which is recognized as a climax dominant on these soils. The soil Groups IV, V, and VI are associated with a mixed type of forest in which certain sub-seres may be recognized, characterized by certain shrub and tree communities. The soil Group VII is associated specifically with the occurrence of Kekilla (*Gleichenia linearis*) in an almost pure consociation, which may be recognized as a fire climax. *From author's summary.*

11.6. *Hydrographical Conditions*

11.6 : 11.4. Lokhov, V. P. **The measurement of rainfall retained by the forests as determined by artificial means.** *Repr.* from *Meteorologiya i Gidrologiya* [*Moscow*] 6, 1938 (97–104). [R.]

Preliminary report on a new method for determining the maximum amount of rainfall that can be retained on the superficial structures of forests (foliage, &c.). Sample trees are felled, sectioned for convenience, and weighed before and after a thorough watering from cans with rose nozzles, the green parts being left in their natural position during watering. The amount of moisture retained is calculated from the increase in weight of the samples. The same method is applied to undergrowth, ground vegetation, and litter, which according to data obtained, frequently retain more rainfall than the trees proper, particularly in the case of coniferous woods.

11.63. Erosion

11.63. Kohnke, H., and Dreibelbis, F. R. **Methods of measuring soil erosion.** *Soil Research* 6, 1939 (232–41).

The approximate total amount of soil that has eroded in the past may be determined either as the difference between the original soil profile and present soil remnants, or by measuring the drainage area and the amount of sediment at the bottom of the watershed. Erosion that is taking place at any time may be determined by collecting run-off and measuring the total soil content or the total available plant nutrient content, depending on which is required.

11.63 : 42.34 : 38.8 (54.5). Gorrie, R. MacLagan. **Reclamation of torrent-ruined lands: a Punjab contribution to rural reconstruction.** *Repr.* from *Agric. Livestock. India* 9, 1939 (248–50).

The suggested steps to be taken are closure of steep slopes to grazing, terracing the lower rim of each field, construction of a series of low stone bunds across the narrow parts of the channels to reduce the velocity of the stream, the planting of cuttings of Banka Bush (*Vitex negundo*) and Nara Reed (*Arundo donax*) along the banks of the broader part of the torrent bed, the planting with Bamboo where such areas are small, and finally the cultivation of stream-side land that is sufficiently fertile. Poor land can be improved with a crop of Sirkanda Grass or Shisham (*Dalbergia sissoo*).

11.63 : 38.8 : 42.34 (54.5). Gorrie, R. MacLagan. **Current problems in erosion control.** *Indian For.* 65, 1939 (254–64).

The closure of land against grazing as a soil conservation measure in the Punjab. The application and extension of legislation in this regard. The need for co-ordinated effort in land reclamation projects and the value of village co-operative societies. Tree and shrub growth is superior to grass for the control of run-off, particularly in increasing the porosity and absorption capacity of the soil. It is suggested that a rotation of forest and field crops would be most efficient in reconditioning sandy land below hills. *Nara-banha* hedges are valuable in combing silt and sand from passing flood waters and in directing the torrent into a main channel.

11.63 : 97.21 (54.7). Inder, R. W. **Soil erosion and grazing problems in Bombay.** *Indian For.* 65, 1939 (345–8).

11.63 : 42.34 : 34.2 (67.6). Maher, C. **Hill culture.—With a supplement on 'Kenya trees yielding edible products'.** *E. Afr. agric. J.* 5, 1939 (36–44).

A consideration of various tree, shrub, and other perennial species, of food or other economic value, both indigenous and exotic, that might be used in soil conservation and at the same time furnish a crop for the dense population in the hills of Kenya.

11.63 : 42.34 (76.8). Seigworth, K. J. **A work unit erosion control survey.** *J. For.* 37, 1939 (623–5).

A field party consisting of an erosion control engineer and a forester examined areas of land and gully erosion, except on pasture and crop land, in eastern Tennessee, and determined the size of the area, type of control measures needed, the number of team days and man days required for preparatory, protection and reforestation work, and the number and species of trees required for planting.

12. TREE SPECIES. FOREST BOTANY

12.11. Physiology. Biology

12.11 : 12.14.5 : 12.25.53–6. Clements, H. F. **Mechanisms of freezing resistance in the needles of *Pinus ponderoso* and *Pseudotsuga mucronata*.** *Res. Stud. St. Coll. Wash.* 6, 1938. pp. 45.

The moisture content of the needles varied according to season, being highest in mid-winter and lowest when the needles were changing from winter to spring conditions. The youngest needles always had the highest moisture content, and the oldest had the lowest. In general, Pine needles had higher moisture content than did those of Douglas Fir. Moisture content is inversely correlated with resistance to low temperatures. Once the needles are completely developed, the total nitrogen, based on residual dry weight, showed no essential variations in relation to either season or age, although the carbohydrates showed striking variations and correlations with these two factors. The soluble sugars, reducing sugars, and sucrose were most abundant during the coldest part of the winter. A second accumulation was correlated with rapid synthesis in spring and early summer. The highest concentrations are found in the oldest needles, and Fir needles contain considerably more sugars than Pine needles. The sugars appear to play a major role in resistance to low temperatures. Starch is very abundant during rapid synthesis but otherwise is present in very small amounts. The acid-hydrolyzable material is shown to be made up of two portions; one is very abundant during rapid synthesis and the other, when once developed, changes very slightly and appears to be involved in the resistance mechanism. Fatty materials show a close correlation with winter temperatures.

12.11.1. *Metabolism. Nutrients. Reserve material*

12.11.1-2. ZOLLIKOFER, C. Zur Wirkung von Oestron und Thyroxin auf ruhende Knospen. **[The effect of oestrone and thyroxin on dormant buds.]** *Ber. dtsch. bot. Ges.* 57, 1939 (67–74). [G.] [Institut für allgemeine Botanik der Universität Zürich.] O.B.D.

Pure oestrone and thyroxin were both shown to stimulate the development of dormant leaf and flower buds in *Corylus avellana*, *Forsythia viridis*, and *Aesculus hippocastanum*.

12.11.1-2. FISCHNICH, O. Weitere Versuche über die Bedeutung des Wuchsstoffes für die Adventivspross- und Wurzelbildung. **[Further experiments on the significance of auxin in the formation of adventitious shoots and roots.]** *Ber. dtsch. bot. Ges.* 57, 1939 (122–34). [G.] [Botanisches Institut der Johann Wolfgang Goethe Universität, Frankfurt a. M.] O.B.D.

The experiments confirm the conclusion previously reached by the author and other workers, that comparatively high auxin concentrations are necessary to induce the formation of roots from the end callus of cuttings, and that at such concentrations shoot development from the callus is inhibited. It is not yet known whether low concentrations of auxin are necessary for shoot formation, or whether auxin merely inhibits shoot formation to a degree varying with its concentration. Experiments on this question are now in progress. Gravity has been shown to exert an effect upon the translocation of auxin in the shoots, and consequently upon callus formation.

12.11.1-2. THIMANN, K. V. **Auxins and the inhibition of plant growth.** *Biol. Rev.* 14, 1939 (314–37). O.R.S.

A general review. Auxin inhibits the growth of shoots, roots, lateral buds, and other organs to a degree that varies with its concentration and the particular organ in question. Some of the phenomena observed after artificial application of auxin are identical with natural growth inhibitions in plants, and it is recognized that some natural growth inhibitions are satisfactorily accounted for by the action of auxins. The chief difficulty at present is to explain why auxin, which promotes growth under certain circumstances, should inhibit it in others. Nine theories have been formulated to explain bud inhibitions, but none of these is as yet completely satisfactory.

12.11.1-2 : 12.14.5. CHOLODNYI, N. G., and GORBOVSKY, A. G. **Influence of β-indolylacetic acid upon photosynthesis.** *C. R. Acad. Sci. U.R.S.S.* 22, 1939 (452–5). [Laboratory of Plant Physiology, Academy of Sciences of the Ukrainian S.S.R., Kiev.] O.R.S.

Detached leaves were kept under controlled illumination and photosynthesis was measured by the rate of CO_2 assimilation. Leaves immersed in a 1 : 1000 solution of β-indolylacetic acid showed a temporary increase in photosynthesis, though if the period of immersion was long the initial rise was sometimes followed by a drop to a subnormal level of photosynthesis. Tests with higher concentrations [10 : 1000] showed no alteration in the rate of photosynthesis. Previous workers have

recorded increased photosynthesis in injured leaves, and it is suggested that this may be explained by the accumulation in wounded leaves of plant hormones that might be expected to have similar effects to that of β-indolyl-acetic acid.

12.11.1 : 12.14.5 : 12.25.3–5. ROBERTS, O., and STYLES, S. A. **An apparent connexion between the presence of colloids and the osmotic pressures of conifer leaves.** *Sci. Proc. R. Dublin Soc.* 22 [*n.s.*], 1939 (119–25). O.R.S.

Plasmolytic and cryoscopic determinations of osmotic pressures in the leaves of various conifers agreed closely in species with cell sap of low viscosity, but differed widely in those where the viscosity was high owing to the presence of mucilaginous colloids. In the latter cases, the osmotic pressures determined plasmolytically were much higher than those obtained by the cryoscopic method. The mobility or viscosity of the cell sap was in most cases a specific difference, but some trees of *Taxus baccata* had a high and others a low sap viscosity.

12.11.12 : 12.28.61. DIXON, H. H. **The convection of heat and materials in the stem of a tree.** *Repr.* from *Sci. Proc. R. Dublin* 21 [*n.s.*], 45, 1936 (477–86.)

The description of apparatus and technique used in the measurement of the convection of heat over short distances in the stem of an Ash, by which the velocities of materials moving up and down the stem can be determined. Average upward velocities varied from 2·1 cm. per hour in January to 38·0 cm. per hour in July when transpiration is most active. Average downward velocities varied from 2·7 cm. per hour in January to 28·6 cm. per hour in July.

12.11.2. *Development. Propagation. Growth*

12.11.2 : 21.5 : 23.26.5. DOAK, B. W. **The use of hormones as an aid to the propagation of plants.** *N.Z. J. Sci. Tech.* 20, 1939 (269A–280A). [Plant Research Bureau, Department of Scientific and Industrial Research, New Zealand.] O.R.S.

Cuttings of a number of species were treated with β-indole-acetic acid, β-indole-butyric acid, α-naphthalene-acetic acid, and two commercial preparations. Many showed a good rooting response with suitable hormone concentrations. β-indole-butyric acid and α-naphthalene-acetic acid gave the best results, some species appearing to respond better to the former, others to the latter. Both substances were more active than β-indole-acetic acid (hetero-auxin). Leafy cuttings rooted better than those with few leaves; dormant deciduous cuttings failed entirely to respond. It is stressed that hormones are not an infallible means of securing vegetative propagation in all species, and that when the method is used, cuttings should be taken at the season and condition of wood likely to give success in the absence of hormone treatment. Suitable hormone concentrations must be determined experimentally for each species.

12.11.2 : 12.14.5 : 21.5 (91). **Notes on bud-grafting.** *Rub. Res. Inst. Malaya Circ.* No. 4. The Rubber Research Institute of Malaya, Kuala Lumpur, F.M.S. 1939. pp. 2.

12.11.2 : 12.14.5 : 21.5 (91). **Bud-grafting:** practical instructions in English, Malay, Chinese, and Tamil. *Plant. Manual Rub. Res. Inst. Malaya*, No. 8. [*Small Holders' Advisory Service Publication*, No. 2.] The Rubber Research Institute of Malaya, Kuala Lumpur, F.M.S. 1939. pp. 61.

12.11.21 : 23.23.11 : 12.25.52–3 (47.2). LEVIN, N. A. **A method for determining seed years in Pine and Spruce.** *Lesnoe Khozyaystvo, Moscow* 7, 1939 (55–7). [R.]

It is proposed to determine the periodicity of seed years in some undeveloped North-Russian Pine and Spruce regions using past statistics on the number of squirrels shot annually. In seed years this number is several times as great as in other years. Statistics on squirrel exploitation dating back to the last century exist for many regions where forest management is being introduced.

12.11.21 : 23.26 : 12.27.49 : 12.26.51. FRANCKE, A. **Descriptions of the germination and juvenile development of some tropical timber trees.** *Kolonialforstl. Mitt.* 2, 1939 (91–108). [G.]

Notes on *Afzelia africana* Sm. (Caesalpin.), *Erythrophleum micranthum* Harms ex Holland (Caesalpin.), and *Musanga smithii* R. Br. (Morac.), illustrated with detailed photographic material of use in identifying these species in the early stages of development.

12.11.22. PEARSE, H. L. **Plant hormones and their practical importance in horti-**

culture. *Imp. Bur. Hort. Plantat. Crops, Tech. Commun.* No. 12. Imperial Bureau of Horticulture and Plantation Crops, East Malling, Kent, England. 1939. pp. 88.

12.11.22. EVENARI, M. [SCHWARZ, W.] and KONIS, E. **The effect of hetero-auxin on root formation by cuttings and on grafting.** *Palest. J. Bot.* [Jerusalem Ser.] 1, 1938 (13–26).

The results of experiments in applying β-indole-acetic acid to cuttings of *Ficus carica*, *Olea europaea*, *Pyrus malus*, *Cydonia vulgaris*, *Vitis vinifera*, *Prunus mahaleb*, and *Pyrus communis*. Callus formation was greatly increased by hormone application in all cases. It was noted that the method of hormone application and the optimal dose cannot be standardized for all cases. The dose of growth substance should not be such as to inhibit excessively bud development, and probably should always be applied to the basal ends of cuttings.

12.11.22. **Root stimulation by 'hormones'.** *Rub. Res. Inst. Malaya Plant. Bull.* No. 4, 1939 (1–5). Rubber Research Institute of Malaya, Kuala Lumpur, F.M.S.

Stumps of Rubber trees, on which both roots and stems were pruned, were soaked in a dilute solution of commercial hormone for 16 to 24 hours. This treatment resulted in an increased number of rooted stumps, and an increase in the total number of roots after periods of 1 and 2 months.

12.11.22 : 23.25.1 : 12.25.52. GRACE, N. H. **Vegetative propagation of conifers. I. Rooting of cuttings taken from the upper and lower regions of a Norway Spruce tree.** *Canad. J. Res.* 17, Sec. C, 1939 (178–80). P.R.

Cuttings from the upper and lower regions of a Norway Spruce tree were treated with talc only, and with talc containing 1,000 p.p.m. indolylacetic acid. Ten weeks after being planted in sand, 43 per cent. of the upper and 75 per cent. of the lower cuttings were rooted. Hormone treatment increased the number of roots per rooted cutting but decreased the mean length of root. Lower cuttings produced twice the length of root of the upper cuttings, and the mean length of individual roots was also significantly greater. Nineteen weeks after being planted, the cuttings not rooted at 10 weeks were reinspected, and gave final rooting values for the experiment of 48 per cent. for upper cuttings and 86 per cent. for lower. Physiological differences are consequently suggested in cuttings taken from the upper and lower regions. *Author's summary.*

12.11.22 : 23.26.5 : 12.25.53. KOMISSAROV, D. A. **Effect of growth substances upon rooting response of cuttings from Pine and other woody species.** *C. R. Acad. Sci. U.R.S.S.* 31, 1938 (453–6). [R.]

The rooting response of cuttings of *Pinus sylvestris*, to treatment with growth substances, varies with physiological and environmental conditions. The optimum treatment and conditions as determined by this investigation were: cuttings from young plants (3 years) collected from the upper part of the axial shoot, from July 5th to 12th [1938], treated with a 0·010 per cent. solution of β-indolyl-acetic acid for 24 hours and planted in sand peat in a hot-house temperature of 30 to 35° C. Such treatment resulted in 70 per cent. rooting. Similar results were obtained using the species *Larix sibirica* and *Quercus pedunculata*. The girdling of lateral shoots with wire a fortnight before treatment increases the rooting response. Neither α-naphthalene-acetic acid nor its K salt were as effective as β-indolyl-acetic acid.

12.11.3. *Heredity. Breeding. Races. Questions of provenance*

12.11.3–5 (489). ORDING, A. Om vekstforedling av skogtrær i Danmark: Dr. Syrach Larsens arbeid i Hørsholm [**Forest tree breeding in Denmark: Dr. S. Larsen's work at Hørsholm.**] *Tidsskr. Skogbr.* 47, 1939 (209–21). [Nor.]

A general account of work in progress at the Hørsholm Arboretum, including research on races and hybrids of Larch and Alder, and on Poplars—particularly *P. vernirubens* Henry. An interesting technique is used for growing greenhouse parent stocks for pollination experiments: branchlets brought from trees in any desired locality are grafted on to small stocks in flowerpots, producing a miniature tree that will often flower and set seed under greenhouse conditions, thus saving much time and space and enabling the experiments to be centralized at one place. Another method in use aims at hastening sexual maturity by a kind of starvation; small seedlings are grown under restricted conditions in pots, which often induces flowering at a precocious age. At Hørsholm there were 1-year old Birches that bore female

flowers in the spring of 1939, and it was hoped that seed might be collected from these during the summer. Research is also in progress on the vegetative propagation of trees.

12.11.3. MINCKLER, L. S. **Genetics in forestry.** *J. For.* 37, 1939 (559–64). [Appalachian Forest Exp. Sta., Asheville, N.C.]

A review of the contributions of many workers in the field of forest genetics, particularly as regards inherited variations affecting rate of growth, resistance to disease, and tolerance to environmental factors. Also the problem of determining the qualities desirable in seed trees.

12.11.3. LANGNER, W. **Breeding for vigorous growth.** *Forstwiss. Cbl.* 61, 1939 (313–18). [G.]

Selection in the seed-bed stage can be improved by eliminating the variable factor of seed size. Before sowing, the seed should be divided into groups according to size. Differences in seedling growth within each group will then correspond more closely to the inherited qualities of the material under selection.

12.11.3 : 01.4. DAY, B. B., and AUSTIN, L. **A three-dimensional lattice design for studies in forest genetics.** *J. agric. Res.* 59, 1939 (101–19). [Institute of Forest Genetics, United States Forest Service.] O.R.E.

A type of experimental design evolved for use in individual seed-tree progeny studies, by means of which the differences in yields or measurements which are due to lack of homogeneity in soil and treatment can be ironed out so as not to interfere in the examination of variety differences.

12.11.3 : 12.15. SCHREINER, E. J. **Some ecological aspects of foreign genetics.** *J. For.* 37, 1939 (462–4). [North-eastern Forest Exp. Sta., New Haven.]

Ecological factors must be considered in relating seed origin to place of planting, and in selecting parent trees for progeny tests in order that trees too favourably affected by environment may be avoided, and in selecting parent trees for hybridization, and selective breeding. The superior races, strains, or types as selected by the forest geneticist should be grown in the most favourable environment as determined by the forest ecologist.

12.11.3 : 12.25.53. RIGHTER, F. I. **A simple method of making germination tests of Pine pollen.** *J. For.* 37, 1939 (574–6).

Melted paraffin is poured into the bottom of a Petri dish to a depth of 2 to 3 mm. Rows of small holes, uniformly spaced, are pricked in the paraffin, by means of a sterile instrument, while it is still warm. Drops of culture of pollen grains and distilled water are placed in the holes by using a sterile hypodermic syringe. The Petri dish is fitted into its inverted cover, which has been moistened with a few drops of distilled water, and an air-tight seal is effected by means of a film of vaseline around the periphery of the cover. The dish is placed in an electric oven adjusted to a constant temperature of 26° C.

12.11.3 : 12.25.53. STOCKWELL, W. P. **Pre-embryonic selection in the Pines.** *J. For.* 37, 1939 (541–3). [California Forest and Range Exp. Sta.]

From the time the pollen grains sift into the axils of the cone scales until the maturity of the Pine embryo there are six or more natural selections which take place either by chance or competitively. Those noted are: (*a*) selection of pollen grains entering the micropylar opening, (*b*) survival of pollen entering pollen chamber, (*c*) suppression of inferior pollen during period of pollen-tube development, (*d*) development of cells in embryo sac into archegonia, (*e*) position and vigour of pollen tubes and archegonia relative to actual germination, and (*f*) the maturing of one or perhaps two of the proembryos that have developed on the suspensor apparatus.

12.11.3 : 44.3 : 12.21 : 12.26.53. PEACE, T. R. **The resistance of Elms to the disease caused by *Ophiostoma* [*Ceratostomella*] *ulmi*.** *Inst. Leafl.* No. 2. 1939. pp. 4. Imperial Forestry Institute, Oxford.

All European species and most of their varieties are susceptible to the disease. North American species are of no importance in Great Britain, and while many Asiatic species are resistant to the disease, they are of small size and also grow poorly in Great Britain. Although the variety *Ulmus stricta* var. *wheatleyi* is susceptible to the disease, the damage is usually not great and it is hoped to obtain a highly resistant strain of typical habit. *Ulmus* '*Christine Buisman*' is a selected resistant variety though of rather inferior habit. Further investigations on this problem are under way in many countries.

12.11.3 : 23.21.6 : 23.23.19 (45). PAVARI, A. **The problem of races and seed of forest trees in Italy.** *Riv. for. ital.* 1, 1939 (22–31). [It.]

12.11.3 : 12.25.53 : 44.3 (47). GAVRIS, V. P. **On the selection of rust-resistant forms of Scots Pine.** *Proceedings of the Lenin Academy of Agricultural Sciences of U.S.S.R.* No. 10, 1939 (29–30). [R.] A.P.B.

Report on an investigation conducted in the north-eastern part of the Jaroslav region in 1938 when damage to seedlings from *Melampsora pinitorqua* was particularly severe. Seedlings grown from the seed of mother trees that produced comparatively heavy seed were relatively immune and the degree of immunity was generally higher in seedlings with 6–8 cotyledons than in those with 4–5, as shown in the simplified table below:

	Seedlings										*Sum*			*In per cent.*	
	4 *cotyledons*		5 *cotyledons*		6 *cotyledons*		7 *cotyledons*		8 *cotyledons*						
Weight 1,000 seeds of mother tree, in grams	*Attacked*	*Healthy*	*Attacked*	*Healthy*	*Attacked*	*Healthy*	*Attacked*	*Healthy*	*Attacked*	*Healthy*	*Total*	*Attacked*	*Healthy*	*Attacked*	*Healthy*
4,165	—	—	8	9	10	15	2	1	—	—	45	20	25	44	56
3,965	1	2	15	12	6	18	—	2	—	—	56	22	34	39	61
4,395	34	17	58	125	29	126	1	9	—	—	399	122	277	31	69
4,975	1	—	39	115	47	197	4	36	1	—	440	92	348	21	79
5,180	3	4	20	96	16	84	4	28	—	2	257	43	214	17	83
5,420	—	—	—	1	1	11	7	28	1	6	55	9	46	16	84
5,700	—	9	7	46	11	63	—	10	—	—	146	18	128	12	88
5,780	—	4	2	48	5	55	4	8	—	—	126	11	115	9	91

12.11.3 : 12.26.22 (47.7). PYATNITSKI, S. S. **The hybridization of Oaks.** *Lesnoe Khozyaystvo, Moscow* 7, 1939 (38–43). [R.]

Preliminary report on experiments conducted since 1937 by the Division of Selection of the Ukranian Scientific Research Institute for Forest Husbandry and Rural Melioration with the Aid of Forestry. The hybridizations attempted were: (1) ♀ *Quercus robur* × ♂ *Quercus borealis maxima*, (2) ♀ *Q. robur* × ♂ *Q. macranthera*, (3) ♀ *Q. robur* × ♂ *Q. macrocarpa*, (4) ♀ *Q. robur* × ♂ *Q. sessilis*, (5) ♀ *Q. borealis maxima* × ♂ *Q. robur*, (6) ♀ *Q. borealis maxima* × ♂ *Q. macrocarpa*, (7) ♀ *Q. macranthera* × ♂ *Q. robur*, (8) ♀ *Q. macranthera* × ♂ *Q. borealis maxima*, (9) ♀ *Q. macrocarpa* × ♂ *Q. robur*, and (10) ♀ *Q. macrocarpa* × ♂ *Q. borealis maxima*.

Acorns (400 in all from over 25,000 pollinations) were obtained from combinations 1, 2, 3, 7, 8, and 10 and were sown out simultaneously. The first seedlings to appear were *Q. macranthera* × *Q. borealis maxima* followed by *Q. robur* × *Q. borealis maxima*. The other hybrids did not come up until 2 months later. At the end of the vegetation period the *Q. macranthera* × *Q. borealis maxima* and *Q. robur* × *Q. borealis maxima* seedlings were twice as high as the other hybrids. *Q. robur* characters appeared to be dominant in combination with other species, while *Q. macranthera* × *Q. borealis maxima* hybrids seemed to occupy an intermediate position between their parents. The latter hybrids had large leaves and showed very great vitality.

12.11.3 : 21.5 : 23.25 : 12.26.41 (485). Snabbväxande poppelhybrider: ett sätt att genom skogsodling på lämpliga lokaler öka våra råvarutillgångar [**Fast-growing Poplar hybrids: a means of increasing our supply of raw material by growing forest in suitable localities.**] *Skogen* 26, 1939 (334–6). [Sw.]

A Swedish patent has been granted to Rost, Djurholm, and McKee for the process of hybridization, selection, and vegetative propagation of which the American patent rights are owned by McKee Poplar Forestation, Inc. Hybrid seedlings produced by artificial pollination are selected in a specified way for low soil demands, rapid straight growth, freedom from branches, leaf colour, and length of wood fibre. A specified method of propagation by cuttings is also employed. The patent is probably the first of its kind in Sweden. No plantings have

yet been made, but contracts are being arranged with large landowners and the first plantings will probably be made in 1940.

12.11.3 : 07.2 (485). SYLVÉN, N. Den svenska 'Föreningen för växtförädling av skogsträd' **[The Swedish 'Forest Tree Breeding Association'.]** *Tidsskr. Skogbr.* 47, 1939 (149–60). [Sw.]

Established in January 1936, the Swedish Forest Tree Breeding Association first began work in the spring of 1938, when buildings and an estate of 22 hectares were acquired at Ekebo, near Svalöf, Skåne. This has now become the chief research station of the Association and is well equipped for its work. Five sub-stations for research on the reaction of trees to local conditions have also been set up in Dalarna, Östergötland, Värmland, Ångermanland, and Västerbotten. The declared aims of the Association are: to carry out in various localities accurate and controlled research upon the value and suitability of native and exotic trees under different conditions; to produce improved types of forest trees and to secure their distribution; and to disseminate knowledge of and pave the way for the use of good planting stock. Methods to be employed include direct selection of parent stock and progeny, inter- and intraspecific hybridization, and the production of polyploids. So far, the chief activities have been an expedition to America to procure a stock of American species, reconnaissance surveys of Swedish forests for suitable native material, and successful research on the production of triploid and tetraploid giant Aspens.

12.11.3 : 12.15.1 : 23.21.6 : 12.25.56 (489). BORNEBUSCH, C. H. **Douglas Fir seed.** [Translated by G. E. Godwin.] *Quart. J. For.* 33, 1939 (184–6).

Growth and form characteristics of various plantations of Douglas Fir in Denmark, the seed for which had been obtained from different parts of the natural range of this species in western America, and to some extent from the earliest stands in Denmark.

12.11.3 : 12.27.77 (73). ANDERSON, E., and HUBRICHT, L. **The American Sugar Maples : I. Phylogenetic relationships as deduced from a study of leaf variation.** *Bot. Gaz.* 100, 1938–9 (312–23). O.B.D.

A biometrical study was made of the leaves of *Acer saccharum* Marsh. (in the broad sense) from groves in various parts of the U.S.A. The New England populations seemed to vary about a single plexus, *A. saccharum* proper; those of south-western Michigan had two almost discontinuous centres of variation, *A. saccharum* proper and *A. saccharum* (Michx. f.) Britton; while groves in southern Missouri and southern Illinois either resembled those in Michigan or else had no recognizable centres of variation. Theoretical average leaves were reconstructed for each population sample. A study of these showed almost no intergrading between *A saccharum* and *A. saccharum* var. *nigrum*, even where they grew in mixture and flowered at the same time. Possible relationships between these forms are reviewed, and it is suggested, on the basis of a statistical prediction of the leaf that might be expected to produce the given result, that *A. saccharum* var. *nigrum* may have arisen from interaction between *A. saccharum* and *A. saccharum* var. *regelii* (Pax) Rehd.

12.11.3 : 12.25.4 : 12.21.9 : 47 (79.4). WOLF, C. B. **Other species of Cypresses as substitutes for the Monterey.** *Calif. Citrogr.* 24, 1939 (222–5). R.A.M. 18 (562–3).

Test plantings were made in an attempt to find species of Cypress resistant to *Coryneum cardinale*, which severely attacks *Cupressus macrocarpa* in California. Eight native species of *Cupressus* were tested. *C. goveniana* and *C. pygmaea* were susceptible: *C. macnabiana*, *C. nevadensis*, and *C. bakeri* are likely to prove resistant, but are too slow-growing for windbreaks; *C. sargentii*, *C. sargentii* var. *duttonii*, and *C. forbesii* are probably immune and are suitable for windbreaks and hedges, some of them growing more rapidly than *C. macrocarpa*.

12.12. Pathology

12.12. DODGE, A. W. **Diagnosing shade-tree troubles.** *Repr.* from *14th Nat. Shade Tree Conf. Proc.* 1938 (118–26).

12.12 : 12.21. GÄUMANN, E. Über die Wachstums- und Zerstörungsintensität von *Polyporus vaporarius* und von *Schizophyllum commune* bei verschiedenen Temperaturen. **[On the intensity of growth and destructive activity of *P. vaporarius* and *S. commune* at different temperatures.]** *Angew. Bot.* 21, 1939 (59–69).

12.12 : 12.21. WILKINS, W. H. **Studies in the genus *Ustulina* with special reference**

to parasitism. IV. Conidia—germination and infection. *Trans. Brit. mycol. Soc.* 23, 1939 (65–85). R.A.M. 18 (638–9).

The conditions affecting the germination of conidia of *Ustulina vulgaris* are examined. It is considered that the conidia of this species are the most probable agents of tree infection in temperate climates.

12.12 : 12.21 : 47. WILKINS, W. H. **Studies in the genus *Ustulina* with special reference to parasitism. V. A disease of Elm [*Ulmus campestris* Sm.] caused by *Ustulina*.** *Trans. Brit. mycol. Soc.* 23, 1939 (171–85).

12.12 : 12.21 : 13.21.85.68.4 : 12.25.51 : 31.42.1. WRIGHT, E. **Further investigations of brown-staining fungi associated with engraver beetles [*Scolytus*] in White Fir.** *Repr.* from *J. agric. Res.* 57, 1938 (759–73).

Brown discolorations have been observed in association with the galleries of three species of scolytid beetles which commonly infest White Fir (*Abies concolor*), namely *Scolytus ventralis*, *S. praeceps*, and *S. subscaber*. It has been determined that the stains are caused by two fungi, *Trichosporium symbioticum*, usually associated with *S. ventralis*, and *Spicaria anomala* which is commonly associated with the other two beetles. Both fungi are pathogenic stains that kill the cambium and may aid the beetles in overcoming infested trees. *From author's summary.*

12.12 : 47 : 12.26.82. RANGASWAMI, RAO SAHIB S., and GRIFFITH, A. L. **Host plants and the spike disease of Sandal.** *Indian For.* 65, 1939 (335–45).

There is a marked difference in the floristic composition of spiked areas and those which have remained healthy for many years. Experiments on potted plants showed great variations in the extent of haustorization of Sandal on different species of host plants. Experiments on the grafting of spiked leaf tissue on to healthy Sandal plants in pots showed that Sandal possesses a very high degree of resistance to the disease when associated with some species of hosts. Experiments in the forest, with natural infection by insects, confirmed these indications of resistance, not only in the species but also very largely in the degree of resistance. In large-scale experiments in the forest the incidence of the disease was greatly reduced by replacing susceptible hosts with resistant hosts. Control measures have been devised by means of which new attacks of the disease can be controlled and eradicated. *From author's summary.*

12.12 : 12.25.53. PEARSON, G. A. **Mortality in cutover stands of Ponderosa Pine.** *J. For.* 37, 1939 (383–7). [Southwestern Forest and Range Exp. Sta., Arizona.]

The most important agencies causing the death of trees are wind, lightning, mistletoe, and insects, the effectiveness of these factors varying with size of tree and site. The rate of mortality appears to be highest in trees of largest diameter, and on cut-over areas the average annual loss of trees 30 in. and over in diameter is about 1 per cent.

12.12 : 12.25.4 : 12.21. MURRILL, W. A. **The cause of Pecky Cypress.** *Bull. Torrey bot. Cl.* 66, 1939 (87–92). O.B.D.

The cause of 'peckiness' in Bald Cypress (*Taxodium distichum*) is said to be the mycelium of *Fomes geotropus*. This fungus attacks living trees of many species, usually near the base of the stem, and causes decay. Fructifications, though not uncommon on many hardwoods, seem to be rare on *Taxodium distichum*. The author describes and illustrates a tree on which he found a bracket of the fungus. 'Pecky' Cypress, once discarded as useless for most purposes, is now much admired for interior decoration. Only about 10 per cent. of the Bald Cypress in the U.S.A. show 'peckiness', and the writer mentions a suggestion that trees might have to be inoculated to meet the increasing demand for the decorative wood.

12.12 : 12.21 : 12.26.41. BIER, J. E. **Septoria canker of introduced and native hybrid poplars.** *Canad. J. Res.* 17, Sec. C., 1939 (195–204). P.R.

Studies have shown that *Septoria musiva* Peck, a North American fungus which occurs commonly as a leaf-spotting parasite on native poplars, produces cankers, in addition to leaf injury, on certain introduced poplars (*Populus rasumowskyana* Schneid., *P. petrowskyana* Schneid., and *P. berolinensis* Dipp.), and the native hybrids, Northwest and Saskatchewan poplar. Field observations and inoculation experiments demonstrated that most of the inoculum for spring infection arises from ascospores of a *Mycosphaerella* stage, and that the fungus enters the stems through mechanical wounds, uninjured lenticels, leaf petioles, or stipules. Incipient cankers occur in the bark of the current year's wood, soon girdling leading

and side shoots. They later spread from lateral branches into the main stem, developing into perennial cankers which ultimately girdle and kill the trees. *Author's summary.*

12.12 : 12.21 : 12.26.41. THOMPSON, G. E. **A leaf blight of *Populus tacamahaca* Mill. caused by an undescribed species of *Linospora*.** *Canad. J. Res.* 17, 1939 (232–8). P.R.

12.12 : 12.27.82. JURAVLEV, I. I. **Parasites and diseases affecting *Euonymus verrucosa*.** *Sbornik Trudov Beresklet* 1938 (119–34). [R. e.] The U.S.S.R. Central Forestry Research Institute, Leningrad.

12.12 : 12.21 : 12.28.61 (497.1). ŠKORIĆ, V. **The Ash canker disease and its causal organism.** *Ann. Exp. for., Zagreb* 6, 1938 (66–97). [Serb. e.] Štamparija Gutenberg, Zagreb, Jugoslavia.

A description of the disease based on Yugoslavian observations and experiments. The cankers are mostly of the sunken and less frequently of the knobby type as described by Van Vliet. Infection experiments led to the conclusion that the Ash organism is distinct from that of the Olive. Accordingly, the new name and the synonyms would be: *Pseudomonas fraxini* (Brown) Škor., *Bacterium savastanoi* var. *fraxini* Brown, *Bacterium fraxini* (Brown) Škor., and *Phytomonas fraxini* (Brown) Škor. It was not possible to make the organism penetrate unwounded bark through lenticels. Rain is considered the main agent in the spread of the disease.

12.12 : 21.21 : 12.26.41 : (71.3). THOMPSON, G. E. **A canker disease of Poplars caused by a new species of *Neofabraea*.** *Mycologia* 31, 1939 (455–65). P.R.

Description of *Neofabraea populi* sp. nov. and of the damage observed on trees of *Populus grandidentata*, *P. tacamahaca*, and *P. tremuloides* in the Temagami Forest Reserve, Ontario.

12.12 : 12.21 : 12.27.48. HIRANE, S. **Studies on the parasitism of the rust of *Acacia confusa* Merrill, *Maravalia hyalospora* (Saw.) Diet. II. Effects of the juice of phyllodes on the germination and germ-tube development of urediospores.** *Trans. nat. hist. Soc. Formosa* 28, 1938 (421–30); 29, 1939 (13–21).

12.12 : 12.21 : 13.21.85.68.4 (43.8). SIEMASZKO, W. Zespoly grzybon towarzyszacych Kornikom polskin [**Fungi associated with bark beetles in Poland.**] *Planta polon.* 7, 1939. pp. 54. [Pol. e.] R.A.M. 18 (488).

The following were constant associates: *Ips typographus* on Spruce (*Picea excelsa* (*P. abies*)) with Saccharomycetaceae, mostly of a type closely resembling *Endomyces bisporus*, and the blue-staining fungi *Ophiostoma* (*Ceratostomella*) *penicillatum*, *O. polonicum*, n.sp., and *Graphium pycnocephalum*. *Ips sexdentatus* on Pine (*Pinus sylvestris*) with Saccharomycetaceae and the blue staining fungi *Ophiostoma* (*C.*) *ips* and *O.* (*C.*) *pini*. *Myelophilus piniperda* on Pine with *O. pini*. *Scolytus scolytus* and *S. multistriatus* on Elm (*Ulmus foliacea*) with Saccharomycetaceae and the blue-staining fungus *Graphium* (*Ceratostomella*) *ulmi*. Descriptions are given of these fungi and many others occasionally associated with the beetles. The most harmful wood-staining fungi in Poland are *Ophiostoma* (*C.*) *pini* on Pine and *O.* (*C.*) *piliferum* and *O.* (*C.*) *caerulescens* on Pine and Spruce. Several new species are described.

12.12 : 12.21 : 12.26.41 (45). SERVAZZI, O. Contributi alla patologia dei Pioppi. VI. Ricerche sulla così detta ' defogliazione primaverile dei Pioppi' [**Contributions to the pathology of Poplars. VI. Researches on the so-called 'spring defoliation of Poplars'**]. *Boll. Lab. Sper. R. Oss. Fitopat. Torino* 15, 1938 [issued 1939] (49–152). [It. f.g.e.] R.A.M. 18 (639–40).

It is stated that diseased material of the type of Poplar known locally as Canadian Poplar (though the exact identity is very doubtful) almost constantly showed the presence of a species of *Pollaccia*, which is named *P. elegans* n.sp., and to which the disease is attributed, though inoculation tests gave only negative results. The fungus causes large triangular black spots on the leaves. *Venturia populina* also occurred on diseased shoots and was proved to be the perfect stage of *P. elegans*. *P. elegans* occurs also on *Populus nigra* var. *italica* and to a limited extent on other species of Black Poplars, e.g. *P. nigra* and the so-called Carolina Poplar; on this last it produced a condition closely resembling 'spring defoliation'.

12.12 : 12.21 (45.4). GHILLINI, C. A. Attacchi di *Phomopsis occulta* su conifere. [**Attacks of *Phomopsis occulta* on conifers**]. *Riv. for. ital.* 1, 1939 (16–22). [It. it.]

Description of the disease and of the damage

to conifers, especially Cypresses, in the Imola region, Northern Italy.

12.12 : 12.21 : 12.26.53 : 47 (47.7–8). DOUDINA, V. S. **The Dutch disease of Elms (*Graphium ulmi* Schw.).** *Gosud. Izdat. Kokhl.-sovkh. Liter.* '*Sel'khozgiz*' (*State Publ. Off. Lit. collect. co-op. Farming* '*Selkhozgiz*'), Moscow, 1938. pp. 47. R.A.M. 18 (488–9).

A general account is given of the disease. In Russia it has so far been found in the Ukraine, in Moldavia, and in the Krasnodar and Saratov districts. Following a severe attack in 1937, 3,500 trees were felled in Saratov. *Ulmus pumila* and *U. pinnato-ramosa*, recorded as resistant by workers in other countries, are widespread in Russian Central Asia and could serve as substitutes for the susceptible varieties.

12.12 : 12.21 : 12.25.56 [489]. BUCHWALD, N. F. Douglasiens Sodskimmel [*Phaeocryptopus gaeumanni*]: en ny Svamp paa Douglasgran i Danmark. [**The Swiss leaf-cast disease of Douglas Fir in Denmark.**] *Dansk Skovforen. Tidsskr.* 1939 (357–82). [Da.]

Extensive reference is made to the papers summarized in *For. Abs.* 1, 1939 [69–71] on the history, distribution, and features of the disease and its causal fungus, and an account is given of the recent discovery of infected woods in Denmark. The disease is now known to occur in Addit Skov and Linaa Vesterskov in Jutland, and in the Giesegaard Skovdistrikt in Zealand. As elsewhere, trees of all ages and races have been infected, but the severity of attack has varied greatly in individual trees and races. Some trees have been so severely defoliated that only the needles of the last one or two seasons' growth remain. In general, 'blue' and 'grey' Douglas Fir appear to sustain more serious injury than 'green' Douglas Fir. Stands of the 'blue' and 'grey' races in the Giesegaard district were severely damaged, while an adjacent plantation of 'green' Douglas Fir was perfectly healthy. The first attacks in the two Jutland woods date from the autumn of 1935, and those in the Zealand woods from about 1936. It is suggested that the disease may have had two centres of distribution in Europe: one in Switzerland, and one in the British Isles. That infection seems to have occurred rather earlier in Jutland than in Zealand bears out this hypothesis and points to spores carried by westerly winds from the British Isles as the source of infection for Denmark. Buchwald's examination of infected material corroborates Rohde's account of the life-history of the fungus, particularly in confirming that spores are ripened and shed in May to June.

12.12 : 12.21 : 12.25.52 (497.1). ŠKORIĆ, V. **Is the characteristic decay of Spruce caused by *Pholiota adiposa* Fr. or by *P. aurivella* [Batsch] Fr.?** *Ann. Exp. for., Zagreb* 6, 1938 (61–5). [Serb. g.] Štamparija Gutenberg, Zagreb, Jugoslavia.

P. aurivella is proved to be responsible.

12.12 : 12.21 : 12.25.4(79.4). WAGENER, W. W. **The canker of *Cupressus* induced by *Coryneum cardinale* n. sp.** *Repr.* from *J. agric. Res.* 58, 1939 (1–46).

First observed in California in 1927, this canker has now become one of the most important epidemic tree diseases of the region, attacking mainly *C. macrocarpa* and *C. sempervirens stricta*. The parasite is described as a new species.

12.12 : 12.21 : 12.27.77 (71.3). BIER, J. E. ***Hypoxylon* canker of Maple.** *For. Chron.* 15, 1939 (122–3). [Dep. Agric., Ottawa.]

As observed on young Red Maple (*Acer rubrum* L.) and Sugar Maple (*A. saccharum* Marsh.) at the Petawawa Forest Experiment Station, Ontario.

12.12 : 47 : 12.26.82 (54.8). RANGASWAMI, R. S. S., and GRIFFITH, A. L. **A note on the control and eradication of new outbreaks of the spike disease of Sandal [*Santalum album*].** *Indian For. Rec.* (*n.s.*) *Silviculture* 3, 1939 (263–90). Manager of Publications, Delhi.

The spike disease of Sandal (*Santalum album*) is a virus disease carried by insects, which are probably $\frac{1}{30}$ in. to $\frac{1}{4}$ in. in size. In a diseased area the sources of infection are (*a*) diseased trees, which may be killed at once by the use of a poison solution 'Atlas tree killer', (*b*) disease masking trees, which may be treated by lopping all the apparently healthy trees found in the diseased locality and girdling and treating with poison all those that manifest the disease subsequently, and (*c*) insect vectors which automatically become non-viruliferous with the removal of the first two factors.

Specimens of diseased material have been distributed to all districts for purposes of identification, and the orders on the proper action in dealing with new outbreaks have been circulated. *From author's summary.*

12.12 : 44.3 (7). Peace, T. R. **Forest pathology in America.** *Forestry* 13, 1939 (36–45).

A brief account of some of the problems encountered in a four months' tour of parts of the United States and Canada.

12.12 : 12 25.53 (71.3). Haddow, W. R., and Adamson, M. A. **Note on the occurrence of needle blight and late fall browning in Red Pine [*Pinus resinosa* Ait.].** *For. Chron.* 15, 1939 (107–10).

These two needle affections have been observed at Midhurst, Ontario, and at a few other localities. They result in considerable damage to the current season's foliage of Red Pine, in close plantations, 5 to 15 years old. While each is distinctive in symptoms and development, they are believed to have a common primary cause, the ovipositing of a gall midge.

12.12 : 12.21 : 12.28.61 : 47 (73). Wolf, F. A. **Leafspot of Ash and *Phyllosticta viridis*.** *Mycologia* 31, 1939 (258–66). R.A.M. 18 (638).

Phyllosticta viridis was identified as the causal fungus of a leaf-spot disease of Ash in the Duke Forest, North Carolina. The disease is known to occur on *Fraxinus americana*, *F. pennsylvanica*, and its variety *lanceolata*, and is presumably widely distributed east of the Rocky Mountains. It attacks trees of all ages, the black fructifications being found either in patches or uniformly distributed over the entire lower leaf surface. With the advancing season pale green spots develop which gradually increase in size. Large trees may be defoliated 4–6 weeks before the killing frosts occur. The perithecial stage of the fungus, maturing by the middle of March, was identified as *Mycosphaerella fraxinicola*. No conidial stage has been found.

12.12 : 12.21 (73). Campbell, W. A., and Davidson, W. ***Poria andersonii* and *Polyporus glomeratus* two distinct heart-rotting fungi.** *Mycologia* 31, 1939 (161–8). R.A.M. 18 (487).

These two fungi are now recognized as distinct on the basis of differences shown in nature and in culture. *Poria andersonii*, commonly isolated from trunk decay of living Oak trees throughout the middle-western States but also reported on Willow, Poplar, and Hickory, is stated to enter through branch stubs, fire scars, and other injuries and to cause a white decay similar to that caused by *Fomes everhartii*; it apparently always develops under the bark and has no pileus. Its setal hyphae are much smaller than those of *Polyporus glomeratus*, and their distribution in the sporophores is more erratic and usually difficult to demonstrate. *P. glomeratus* causes a white to light-brown spongy heart rot of Maples, occurs also on Beech, and is common on Sugar Maple in some areas in the Lake States; it develops on the outside of the bark, usually with some indication of a pileus, and has large setal hyphae easily detected in the sporophores. Differences in culture are also dealt with.

12.12 : 12.21 : 12.26.41 : 47 (75). Wolf, F. T., and Wolf, F. A. **A study of *Botryosphaeria ribis* on Willow.** *Mycologia* 31, 1939 [217–27). R.A.M. 18 (486–7).

Willow canker caused by *Botryosphaeria ribis* is widely prevalent on species of *Salix* throughout the south-eastern United States. The fungus is capable of killing trees within a period of 3–4 years. The course of the disease and the behaviour of the fungus in culture are described in detail.

12.13. Embryology

12.13–4 : 12.25.4. Buchholz, J. T. **The morphology and embryogeny of *Sequoia gigantea*.** *Amer. J. Bot.* 26, 1939 (93–101).

12.13–4 : 12.26.32 : 12.27. 48–9. Neumann, O. Über die Bildung der Wurzelhaube bei *Juglans*, *Mimosa* und *Lupinus* [**On the formation of the root cap in *Juglans*, *Mimosa*, and *Lupinus***]. *Planta Arch. Wiss.* 30, 1939 (1–20). [G.] O.B.D.

Origin and early development of the root-cap in the embryo.

12.13 : 12.25.4. Buchholz, J. T. **The embryogeny of *Sequoia sempervirens* with a comparison of the *Sequoias*.** *Amer. J. Bot.* 26, 1939 (248–57). [Department of Botany, University of Illinois.] O.B.D.

The gametophytes and early embryonic development of *S. sempervirens* are described in detail and the embryogeny of the species is compared with that of *S. gigantea* and other conifers. Including external features, at least 55 important differences are now known to exist between the two *Sequoias*, and of these differences almost a third are considered to be of generic value. It is concluded that the two *Sequoias* should be placed in separate genera.

12.14. Organography. Morphology. Anatomy

12.14 : 12.27.34. Blank, F. Beitrag zur Morphologie von *Caryocar nuciferum* L. **[The morphology of *Caryocar nuciferum* L.]** *Repr.* from *Ber. schweiz. bot. Ges.* 49, 1939 (438–94). [G.g.]

12.14.1. Priestley, J. H., and Scott, L. I. **The formation of a new cell wall at cell division.** *Repr.* from *Proc. Leeds phil. lit. Soc.* 3, 1939 (532–45). P.R.

12.14.2. Clarke, S. H. **Stresses and strains in growing timber.** *Forestry* 13, 1939 (68–79).

A review of the main conclusions of a number of investigations on the occurrence of stresses and strains in growing timber. The most important stimulus leading to the formation of reaction wood [including 'compression' and 'tension' wood] is gravity. Other aspects discussed are the effect of the fine structure of the cell wall, the properties of reaction wood, and the occurrence of strains in the living tree. The results of these investigations emphasize the importance of producing straight, upright, evenly grown trees.

12.14.2. Esau, K. **Development and structure of the phloem tissue.** *Bot. Rev.* 5, 1939 (373–432).

A review of the literature on phloem structure and a statement of modern concepts. The modern morphological concept of the phloem is that of a tissue containing highly specialized elongated enucleate cells with permeable cytoplasm arranged in longitudinal rows and forming anastomosing strands together with the parenchymatous members of the phloem. These specialized cells—that is, the sieve-tube elements or their counterparts—are intimately connected with each other. In most plants these connexions are localized in wall areas occupied by the sieve-plates or by similar structures comparable to highly developed simple pits. The connecting strands, although varied in size, are larger than ordinary plasmodesmata and are usually associated with variable amounts of callose in the wall region that they traverse. The parenchyma cells show different degrees of ontogenetic and physiologic relation to the sieve-tube elements. The companion cells of angiosperms are most closely associated with the sieve-tube elements; then follow the albuminous cells of the gymnosperms and finally the phloem parenchyma and ray cells. When the sieve-tube reaches maturity its protoplast is in a premortal state. The element is, therefore, rather short-lived. The companion and albuminous cells die at the same time as the sieve-tubes. *Author's summary.*

12.14.2 : 12.25.3–5. Abbe, L. B., and Crafts, A. S. **Phloem of White Pine and other coniferous species.** *Bot. Gaz.* 100, 1938–9 (695–722). O.B.D.

The main body of the paper is devoted to an account of sieve-tube development, from differentiation up to death and collapse, in *Pinus strobus* L. In mature sieve-tubes the nucleus disintegrates and the cytoplasm loses mobility, becomes fibrous in texture and pressed closely against the cell wall, and appears to enter a state of low activity and high permeability. The investigation as a whole gives little support to theories of phloem transport that require streaming or a state of high activity in the mature sieve-tube cytoplasm. Other conifers examined had phloem similar in most respects to that of *P. strobus*, but a feature of some genera was the presence of phloem fibres. Secondary thickening of the cell wall seemed to be limited to such fibres in the Cupressineae, Taxodineae, and Taxineae: in the Abietineae fibres are absent and secondary thickening was found to occur in the walls of the sieve-tubes.

12.14.2 : 12.25.3–5. Preston, R. D. **The wall of the conifer tracheid as a single spiral complex.** *Repr.* from *Proc. Leeds phil. lit. Soc.* 3, 1939 (546–52). P.R.

As a result of the re-examination of X-ray diagrams and optical phenomena, it is suggested that the crossed fibrillar model of the conifer tracheid must be abandoned. This is supported by further optical examination of the wall. Detailed observations on sections of conifer wood indicate that the central layer of the wall has different optical properties largely on account of a considerable angular dispersion of the cellulose chains composing it. A new model of the tracheid wall is put forward along these lines. *Author's summary.*

12.14.3 (47.9 : 57.6). Gursky, A. V. **Root systems of trees in steppe and desert soils.** *Proceedings of the Lenin Academy of Agricultural Sciences of U.S.S.R.* No. 5–6, 1939 (45–9), [R.] A.P.B.

Root studies with diagrams of 26 species in Kuban black steppe soils and Turkman grey

desert soils. The deepest and most intensive root systems were found in species growing on the dry sites of the forest steppe, e.g. *Quercus robur* with a root depth 7·5 m. and *Fraxinus excelsior* with a root depth 8 m., and the shallowest and least intensive on the relatively moist sites of the forest steppe, e.g. *Fraxinus mandschurica* Max. with a root depth 1·5 m., *Populus* species with a root depth 2–4 m., and *Juglans mandschurica* Max. with a root depth 2 m.

12.14.5 : 12.25.52. Marco, H. F. **The anatomy of Spruce needles.** *Repr.* from *J. agric. Res.* 58, 1939 (357–68).

12.14.5 : 12.25.53. Griffioen, K. **Changes in the composition of the needles of *Pinus austriaca* Link during the ageing-process.** *Rec. Trav. bot. néerland.* 36, 1939 (347–55). [E.] L.S.

The growing parts of the pine needles are rich in water and in products soluble in ether and alcohol-benzene, very rich in tannin and poor in cellulose, pentosan, lignin, and pectin.

The full-grown parts which are present already at a short distance from the base have a rather constant composition during the ageing of the whole needle. The percentage of dry matter has been augmented and that of soluble compounds diminished. There is a considerable increase of cellulose, pentosan, and lignin, an important decrease of tannin, but no change in the percentage of pectin.

12.14.5 : 12.25.53. Vasilevskaya, L. M. **On the presence of central resin ducts in the needles of various Pines and on the character of their communication with the resin system of the twig.** *Trudȳ Tbilisskogo Botanicheskogo Instituta* 4, 1938 (121–37). [R. georg. e.]

12.14.5 : 12.25.53. Djaparidze, L. I., and Vassilevskaja, L. M. **On the presence of resin ducts in the conductive nerve of Pine needles.** *Trudȳ Tbilisskogo Botanicheskogo Instituta* 2, 1938 (40–8). [R.e.]

12.14.5 : 12.25.53. Askew, H. O. **The chemical composition of *Pinus radiata* needles.** *Repr.* from *N.Z. J. Sci. Tech.* 18, 1937 (651–5). *Cawthron Institute Publication* No. 11.

Chemical analysis of 1-year-old and 2-year-old *Pinus radiata* nursery plants indicates that the mineral and nitrogen content is greatest in the leaves, least in the roots, and the stems are intermediate. As a tree grows older the young needles become poorer in lime, phosphoric acid, soda, chlorine, iron, and insoluble ash, and richer in magnesia, nitrogen, potash, and manganese, while the soluble ash content remains fairly constant. As the green needles on older trees mature, their content of nitrogen and phosphoric acid decreases while soluble ash, lime, manganese, and chlorine increase on the basis of dry matter, and magnesia, potash and iron remain fairly constant. Two-year-old nursery trees, at the rate of 175,000 per acre, make demands for plant foods per acre equivalent to over 600 lb. of sulphate of ammonia, nearly 500 lb. of super-phosphate, nearly 100 lb. of carbonate of lime, and 80 lb. of sulphate of potash.

12.14.8 : 31.3 : 32.31.24 : 12.25.53. Friese, H., Clotofski, E., and Döderlein, R. **On the chemical composition of Pine bark.** *Ber. dtsch. chem. Ges.* 72, 1939 (1226–32). [G.] P.R.

12.15. Mode of life. Adaptability

12.15 : 12.27.48–9 : 11.43.1. Wilson, J. K. **Leguminous plants and their associated organisms.** *Cornell Univ. agric. Exp. Sta. Mem.* 221. Cornell University, Ithaca, New York. 1939. pp. 48.

A study of the relations between leguminous plants and their associated organisms.

12.15.2. Eckardt, T. Die Wuchsform der Bäume und Sträucher. [**The growth habit of trees and shrubs**] *Chron. bot.* 5, 1939 (151–3). [G.] O.B.D.

The difference in habit of growth between trees and shrubs is briefly discussed. Stress is laid upon the work of Troll, who has demonstrated that the chief factor determining habit is the region from which the growth of the main shoots is initiated at rhythmically recurring intervals. In trees the active development of the shoot system takes place in the apical region ('acrotony'), thus leading to the formation of bole and crown; whereas in shrubs the main divisions of the shoot system are initiated at the base of previous shoot systems ('basitony'), the result being the characteristic bushy habit. Reference is also made to the work of Rauh, who has made a significant comparison of shrubs that develop aerial and subterranean runners with herbaceous perennials of similar habit.

12.15.2 : 12.25.52(47.2). YURRE, N. A. **Types of branch formation in Norway Spruce.** *Lesnoe Khozyaystvo, Moscow* 7, 1939(30–7). [R.]

The occurrence of various types of Spruce tree, differentiated by Nils Silven on the basis of branch characteristics, is correlated with North Russian forest types, and it is shown that seed viability varies with the different types.

12.19. Geographical distribution. Plant Geography and Sociology. Forest types and woodland communities

12.19 : 11.44. CULLEY, M. **The decagon for vegetation studies.** *J. For.* 37, 1939 (492–3). [Southwestern Forest and Range Exp. Sta., Arizona.]

A relatively accurate method of studying the density, by species, of low-lying ground vegetation.

12.19 : 09.7 : 12.26.22 (45.2). FENAROLI, L. **Sketch of the distribution of Chestnut forests in the mountains of Lombardy.** *Riv. for. ital.* 1, 1939 (24–30). [It.]

12.19 : 12.25.53 (57). KRUBERG, J. K. **On the geographical distribution of *Pinus silvestris* in the Asiatic part of the U.S.S.R.** *Scientific Memoirs of the Herzen State Pedagogical Institute and the State Institute for Scientific Pedagogy, Leningrad* 4, Part 2, 1937 (241–54). [R.e.] A.P.B.

Report based on soil-botanical expeditions of the Academy of Sciences of U.S.S.R.

12.19 (66.2). LAJUGIE DE LA RENAUDIE, R. **A phytogeographical study of the forest and shrub formations of the Sudan Region of the French Sudan Colony.** *Bull. Rech. Soudan.* 5–6, 1936 (222–47). [F.]

12.19 : 11.1 (66.9). EVANS, G. C. **Ecological studies on the rain forest of Southern Nigeria: II: The atmospheric environmental conditions.** *J. Ecol.* 27, 1939 (436–82).

For Part I see *Forestry Abstracts*, Vol. I, No. 2, pp. 82–3.

Observations on atmospheric environmental conditions were made as a part of a programme of autecological studies of selected species of the undergrowth flora. The concentration of carbon dioxide in the undergrowth of the Nigerian rain forest was not observed to exceed 0·06 per cent. by volume, and thus is of the same order as that in temperate woods. There is a marked diurnal variation, values much above 'normal' being recorded only in the morning, there being a steady fall from sunrise to noon. There are no significant differences between the concentrations observed in primary and in 14-year-old secondary forest. These observations agree in general with those of Stocker at Tjibodas in Java.

Data derived from thermograph records of the conditions of temperature and humidity in the undergrowth and tree tops at the end of the dry and the beginning of the wet season are given. From the days covered by these data two are selected for the consideration of the daily progress of temperature, of relative and absolute humidity, and of saturation deficit. Comparisons are made between the tree tops and the undergrowth, and between the dry and wet seasons. A similar analysis is given for days at Buitenzorg and Tjibodas in Java and in the neighbourhood of Rio de Janeiro. In general the undergrowth of tropical forest is characterized by a period of saturation during the night, the length of this being very variable, and by a rise of saturation deficit during the morning to a maximum which in no case greatly exceeds 10 mm. Hg and is often much less. There are very small changes in the absolute humidity when the air is not saturated, not only in the undergrowth but also in the open air close to the forest.

The daily progress of intensity of illumination in the undergrowth of primary forest in Nigeria follows a fairly steady course, with few major deviations. Sunflecks are, on the whole, small both in size and intensity and are confined to a period of about 5 hours near mid-day. Conditions of illumination in primary and in 14-year-old secondary forest (which has probably passed the darkest phase of the succession) are similar as regards incidence of sunflecks, absolute intensity as measured by the Weston cell, and spectral composition. The secondary forest appears to be on the whole somewhat darker. When the sun is obscured by cloud the intensity of illumination in it is roughly ½–1 per cent. of the intensity in the open near the same forest. It is probable that the same ratio holds good when the sun is unobscured.

The possible effects of the environmental conditions observed in Nigeria on the life of the undergrowth plants are discussed. *From author's summary.*

12.19 (66.9). URVOY, Y. **Data for a phytogeographical map of the Niger Basin.** *Bull. Com. A.O.F.* 21, 1938 (174–6). [F.]

12.19 : 09.7 (67.6). DALE, I. R. **The woody vegetation of the Coast Province of Kenya.** With an appendix entitled 'Additions and corrections to the "Trees and shrubs of Kenya Colony" [1936]'. *Inst. Pap.* No. 18. Imperial Forestry Institute, University of Oxford. 1939. pp. 28.

In general the topography of Kenya is flat with low hills along the coast and a short distance inland to the south-west. Farther inland the Zeita Hills reach an elevation of 7,248 ft. With the exception of these hills the rainfall is confined almost entirely to within 30 miles of the coast. Various soil types are found in the country including sands, clays, red earths, grits, and shaly soils.

The vegetation types are numerous, and the distribution of vegetation and type boundaries has been determined to a large extent by the relative availability of water. Man has also influenced and compiicated these factors to some extent. The vegetation types that are now recognized are described and the representative species listed for each.

12.19 (67.7). CIFERRI, R. Le associazioni del litorale marino della Somalia Meridionale. **[The plant associations of the marine littoral of Southern Somaliland.]** *Repr.* from *Riv. Biol. colon.* 2, 1939 (5–42), [It.f.e.g.]

A general and geomorphological description of the region between the Indian Ocean and the left shore of the Uebi Scebeli, is followed by a brief survey of the Oceanic associations of the beach, the semi-consolidated sandy plains, the rocks, the dunes, both drifting and consolidated, the plains of the hinterland, the periodically flooded areas, and the emerged river banks. Included are notes on the salt plains in the South and a general discussion on succession in the region under survey.

12.19 : 09.7 (73). **The forest regions of the United States.** *Wood* 4, 1939 (232–3).

Synopsis of forest types and principal species.

12.19 (75.2). BEAVEN, G. F., and OOSTING, H. J. **Pocomoke Swamp: a study of a Cypress swamp on the eastern shore of Maryland.** *Bull. Torrey bot. Cl.*, 66, 1939 (367–89). O.B.D.

Pocomoke Swamp is probably the most northerly extensive area of its kind, its flora and habitat factors being more closely related to those of the southern swamps than to those of the northern bogs. The forested area is dominated by *Taxodium distichum*, *Nyssa biflora*, and *Acer rubrum*. The shrub and herb layers are restricted by poor light and drainage. *Chamaecyparis thyoides* is rare in the wetter parts, but forms almost pure stands on drier ground. Tide and drainage markedly affect the richness of the flora, the greatest variety of species being found in the transition from swamp to upland, which is characterized by an increased number of tree species and thickets of evergreen shrubs. Open, raised, sandy areas within and bordering the swamp show many pine-barren species. Parts of the swamp have been completely devastated by fire, and in such areas pioneer species have initiated a hydrarch succession.

12.19 (813). FREISE, F. W. **Some remarks on sociological conditions in virgin forest: observations in the virgin forests of the Brazilian coast.** *Z. Weltforstwirt.* 6, 1939 (603–21). [G.e.f.]

Notes on creepers, parasitic plants, shrub associations, ants, termites and the yet unexplained absence of certain mixtures of tree and shrub species. Most of the sociological relationships in the forests in question still await causal interpretation.

12.19 : 09.7 (96.9). EGLER, F. E. **Vegetation zones of Oahu, Hawaii.** *Emp. For. J.* 18, 1939 (44–57).

The island of Oahu is 604 sq. miles in area, the third in size of the Hawaian group in the Pacific Ocean. It is of volcanic origin and consists of two mountain ranges averaging from 600 to 1,000 metres in altitude and separated by a plateau. Narrow coastal plains and reefs border the mountains near the sea. The total annual precipitation varies from 10 in. near sea-level to a maximum of 300 in. at higher elevations, and the monthly mean temperature usually ranges between 65° and 80° F.

Three distinct floras are recognized on the island—a tropical strand flora, a xero-tropical flora, and a pluvio-tropical flora. The distribution of the strand vegetation is dependent on favourable secondary edaphic conditions rather than the general climate, whereas the main factor controlling the distribution of the xero-tropical and pluvio-tropical floras is the amount of precipitation. Within distinct zones of vegetation an equilibrium has become estab-

lished between the flora and certain environmental features. These zones extend in concentric bands around the mountain ranges, and have been segregated on the basis of (*a*) uniformity of flora, and (*b*) uniformity of response of vegetation to climate. The zones here recognized and described are:

1. Xero-tropical zones within areas having an annual rainfall of 10 to 50 in. and extending to a maximum elevation of 1,380 ft. Only 5 per cent. of the species in these zones are indigenous.

(*a*) *Makai* xero-tropical zone characterized by abundance and variety of annuals.

(*b*) Middle xero-tropical zone.

(*c*) *Manka* xero-tropical.

The characteristic species of each zone are noted. The closed woodland of *Prosopis chilensis* covers practically all alluvial coastal plains, raised reefs, and coastal sands, whereas the steep slopes of the foothills bear xeroid scrub and grassland.

2. Pluvio-tropical zones are found where annual precipitation is over 50 in., mainly in the higher parts of the mountains and down to the sea-level on the windward side of the island.

(*a*) The *Guava* zone bears a mixed vegetation, mainly of introduced grasses and shrubs. The tree species *Psidium cattleianum* var. *lucidum*, *Eugenia jambos* L. and *Eugenia jambolana* Lam. are able to invade this zone.

(*b*) The *Koa* zone bears a varied savanna and its indigenous forest flora and favourable climate indicate a relatively high potential for timber production.

(*c*) The *Ohia* zone is characterized by high precipitation, relatively low sunlight, and the presence of a decadent mesophytic forest dominated by *Metrosideros collina* subsp. *polymorpha*.

(*d*) The Cloud zone has the most precipitation [200 in. or more per year] and least sunlight of all the zones, and there are numerous dominant species in the vegetation, each characterized by stunted growth and small leaves.

The principal species are named for each zone and ecological factors are discussed.

12.19.2 (213). RICHARDS, P. W., TANSLEY, A. G., and WATT, A. S. **The recording of structure, life-form, and flora of tropical forest communities as a basis for their classification.** *Inst. Pap.* No. 19. Imperial Forestry Institute, University of Oxford. 1939. pp. 19.

The discussion of a plan for the collection and recording of information on the description and classification of tropical forest communities. A list of 42 points is suggested as the most important for record by forestry officers.

12.19.2 (43.1). SCAMONI, A. **Preliminary suggestions on the classification and mapping of the forest associations on the diluvial soils of Eastern Germany.** *Z. Forst- u. Jagdw.* 71, 1939 (321–43). [G.]

Suggestions for a floristic and ecological classification, the latter to include the 5 alliances *Alnion*, *Fraxino-Carpinion*, *Fagion*, *Quercion rob.-sess.*, and *Pineto-Piceion boreale*. The terms and technique of the surveys is to be based on Braun-Blanquet.

12.19.2 : 12.25.52 (43.21). REINHOLD, F. **A tentative classification and review of the natural Spruce forests [*Piceion excelsae*] of Saxony.** *Tharandt. forstl. Jb.* 90, 1939 (229–71). [G.]

Ecological survey with reference to the choice of species for mixtures.

12.19.2 : 12.25.53 (47.9). TUMADJANOV, I. I. **An ecological ['geobotanical'] sketch of the Pine forests of the Ateny defile.** *Trudy Tbilisskogo Botanicheskogo Instituta* 2, 1938 (233–64). [R.e.]

12.19.2 (497.13). HORVAT, I. **Plant-sociological forest research in Croatia.** *Ann. Exp. for., Zagreb* 6, 1938 (127–279). [Serb.g.] Štamparija Gutenberg, Zagreb, Jugoslavia.

12.19.2 : 12.25.53 (497.2). JORDANOFF, L. **An important station of *Pinus peuce* Griseb. in Bulgaria.** *Lesovodska Missal* 7, 1938 (115–23, 232–5). [Bulg.g.]

The description of a pure stand of *Pinus peuce*, 1,200 hectares in extent, forming part of the Trite Reki State forest on the southern slope of the Pirin mountains. The best developed trees, having heights up to 38 metres at 80 to 100 years, are found at elevations of 1,800 to 2,100 metres. At these elevations regeneration is excellent, even on very stony soils. In other parts of the state forest *Pinus peuce* occurs in mixture with Scots Pine, Spruce, Silver Fir, and Beech.

12.19.2 (67). MICHELMORE, A. P. G. **Observations on tropical African grasslands.** *J. Ecol.* 27, 1939 (282–312).

12.19.2 (76.1). PENFOUND, W. T., and HALL, T. F. **A phytosociological analysis of a**

Tupelo Gum [*Nyssa aquatica*] **forest near Huntsville, Alabama.** *Ecology* 20, 1939 (358–64).

12.19.2(944). FRASER, L., and VICKERY, J. W. **The ecology of the Upper Williams River and Barrington Tops Districts.** *Proc. Linn. Soc. N.S.W.* 52 (139–84): 53 (269–83): 54 (1–33). 1937–38–39. P.R.

The region is described as to topography, drainage, geology, soil, and climate. Three plant formations are present in the area studied: 1. The sub-tropical rain forest is a tall, dense, complex forest with a continuous and conspicuous tree stratum and scanty shrub and herb strata. It is found in sheltered valleys from 1,000 to 3,000 ft., the vegetation becoming poorer with increase in altitude. The forest is not homogeneous in composition, and species vary with local habitat. Special features of this forest, such as lianes, epiphytes, buttressing of tree trunks, and leaf features, are described. 2. Above 3,000 ft. the sub-tropical rain forest gives way to the sub-antarctic rain forest which is found on sheltered slopes and along creeks up to 5,000 ft. It is dominated by the antarctic Beech *Nothofagus moorei*. The forest canopy is moderately dense, very thick, and with no marked stratification. 3. The Eucalypt forest formation surrounds the two rain-forest formations, occurring in areas of less shelter and moisture on ridge tops and upper slopes from 1,400 to 5,000 feet. It comprises a more or less continuous, thin canopy of different species of *Eucalyptus*, in various associations, and a number of fairly well-defined strata of shrubs and undergrowth. The composition of the forest varies with altitude and the average tree height decreases from more than 150 ft. on the valley floor to less than 40 ft. on the more exposed parts of the plateau. Both rain forests are advancing on the Eucalypt formation wherever conditions are favourable.

Various ecological aspects of these forest formations are discussed and lists of species occurring in them have been compiled.

12.19.2 (96.9). ROBYNS, W., and LAMB, S. H. **Preliminary ecological survey of the island of Hawaii.** *Bull. Jard. bot., Brux.* 15, 1939 (241–92). [E.]

12.2. *Special (Systematic) Botany*

12.2(59.1). FISCHER, C. E. C. **Contributions to the flora of Burma: XVI.** *Kew Bull.* 7, 1939 (334–7).

12.2 (811). SMITH, A. C. **Plantae Krukovianae: VI.** New species from Amazonian Brazil, with diagnoses in Latin. *J. Arnold Arbor.* 20, 1939 (288–303).

12.2 (95). MERRILL, E. D., and PERRY, L. M. **Plantae Papuanae Archboldianae. I.** New Guinea plants, including Latin diagnoses of many new species. *J. Arnold Arbor.* 20, 1939 (324–44).

12.21. MOUNCE, I., and MACRAE, R. **Interfertility phenomena in *Fomes pinicola*.** *Repr.* from *Canad. J. Res.* 16, 1938 (354–76).

12.21. GROVES, J. W. **Some *Pezicula* species and their conidial stages.** *Canad. J. Res.* 17, Sec. C. 5, 1939 (125–43). P.R.

12.21. ŠKORIĆ, V. **Studies on the biology, development, and pathogenic properties of *Lentinus tigrinus* (Bull.) Fr.** *Ann. Exp. for., Zagreb* 6, 1938 (98–126). [Serb.e.] Štamparija Gutenberg, Zagreb, Jugoslavia.

12.21 (77). BAXTER, D. V. **Some resupinate Polypores from the region of the Great Lakes. X.** *Repr.* from *Pap. Mich. Acad. Sci.* 24, 1938–9 (167–88). P.R.

12.25.3 : 23.38 (67.1). CHEVALIER, A. ***Podocarpus* in the Cameroons.** *Rev. Bot. appl.* 19, 1939 (411–14). [F.] P.R.

First recorded occurrence in the Cameroons of *Podocarpus mannii* Hk.f. (apparently cultivated only) and *P. milanjianus* Rendle (indigenous). The indigenous species was found on both sides of the Anglo-French frontier. *P. mannii* is considered suitable for savanna afforestation on the Dschang plateau (alt. 1,000–2,000 m.) since it resists the invasion of grasses to which other local broad-leaved species succumb. *P. milanjianus* is similar in habit, but of lower stature and hence of no more economic interest than the species already under cultivation.

12.25.51 (72 : 728.1). REHDER, A. **The Firs of Mexico and Guatemala.** *J. Arnold Arbor.* 20, 1939 (281–7).

Botanical description and the range of *Abies religiosa*, *A. hickelii*, *A. guatemalensis*, and *A. concolor*.

12.25.51 : 12.19.2 (44.97). CUSIN. **Silver Fir forests of the High Alps.** *Rev. Eaux For.* 77, 1939 (120–9, 213–24). [F.]

A report on distribution, biology, ecology,

management, silviculture, and revenue. The Silver Fir of the High Alps (Département Hautes-Alpes) is a moderate light demander and much more drought resistant than the Vosgian race. Difficult regeneration and deficiency in young growth are ascribed to over-conservative management up to the present, which has involved accumulation of old and partly overmature timber.

12.25.52 (71.1). RECKNAGEL, A. B. **Notes on the Upper Fraser River Valley Spruce of British Columbia.** *J. For.* 37, 1939 (656–7).

Identification by cone examination has established the fact that the Spruce along the Prince Rupert Division of the Canadian National Railway, between Prince George and McBride (along latitude 54° N. between longitude 120° and 123° W.) in northern interior British Columbia is predominantly White Spruce and not Engelmann Spruce as was supposed previously.

12.25.52 : 22.14 : 09.7 (44.48–9). FRANÇOIS, T. Les forêts d'épicéas des Alpes. [**The Spruce forests of the Alps.**] *Rev. Eaux For.* 77, 1939 (581–98). [F.]

In the author's opinion, Spruce is the most valuable timber species of the French Alpine selection forests. Group selection fellings should be made on a large scale, favouring Spruce regeneration rather than that of Silver Fir and Beech.

12.25.53 (43.64). POHL, F. **On a form of *Pinus silvestris* that flowers every year.** *Forstwiss. Cbl.* 61, 1939 (389–91). [G.]

Notes on an isolated tree growing on the Puflatsch slope in Southern Tyrol. The form which is believed to be var. *monticola* Schroeter (1895) produces male flowers every year. Its needles persist for 5 years. The same variety was observed in England by Burbridge.

12.25.53 (44.89). BARRAULT, H. Le pin a crochets dans le Département des Pyrénées-Orientales. [***Pinus montana* var. *uncinata* in the Département des Pyrénées-Orientales.**] *Rev. Eaux For.* 77, 1939 (609–19). [F.]

12.25.53 (493). POSKIN, A. **The cultivation of Corsican Pine [*Pinus nigra* var. *calabrica* Schneid.] in Belgium.** *Bull. Soc. for. Belg.* 46, 1939 (273–99). [F.f.]

12.26.32 (43). SCHWARZ, H. **The cultivation of *Juglans nigra* L. in Greater Germany.** *Allg. Forst- u. Jagdztg.* 115, 1939 (268–70). [G.]

12.26.34 : 12.26.51 : 31 (63). GIORDANO, G. **Monographic notes on the trees of Italian East Africa and on their woods.** *Riv. for. ital.* 1, 1939 (41–6). [It.]

Notes on *Myrica salicifolia* Hochst. and *Morus mesozygia* Stapf.

12.26.41 : 07.8 (44.32). BARBEY, A. **In the country of Poplar plantations.**—*J. for. suisse* 90 1939 (141–8). [F.]

Notes on a tour in the Marne valley, including a summary of the French classification of Poplars.

12.26.51 : 31 : 2 (6). TONDEUR, G. **A monograph of *Chlorophora excelsa* Benth. & Hook. from the forestry point of view.** *Bull. agric. Congo belge* 30, 1939 (163–98). [F.]

Botany, wood technology, and silviculture, including protection, afforestation, and stump production in nurseries.

12.26.53. MELVILLE, R. **Ambiguous Elm names. 1. *Ulmus sativa* Mill.** *J. Bot., Lond.* 77, 1939 (244–8). O.B.D.

Conclusive evidence of the identity of *U. sativa* Mill. is lacking and the name has been used for 5 different species; it is therefore proposed that *U. sativa* should be rejected as a *nomen ambiguum*.

12.26.53 (42.5–6). MELVILLE, R. **Contributions to the study of British Elms. II. The East Anglian Elm.** *J. Bot., Lond.* 77, 1939 (138–45). O.B.D.

Ulmus diversifolia Melville is described and figured as a new species, and an outline is given of its distribution in East Anglia.

12.27.13 : 12.19.1 (91.1). AIRY-SHAW, H. K. **Additions to the flora of Borneo and other Malay islands. XII.** The *Annonaceae* of the Oxford University Expedition to Sarawak, 1932. *Kew Bull.* 6, 1939 (275–90).

12.27.31 (67.5). STANER, P. **Revision of the Congo species of the genus *Tetracera* L.**—With key. *Bull. Jard. bot., Brux.* 15, 1939 (295–305).

12.27.36 (8). SMITH, A. C. **Studies of South American plants. VII. Notes on Quiinaceae.** *Trop. Woods* 58, 1939 (25–32).

12.27.37. KOBUSKI, C. E. **Studies in *Theaceae*. IV. New and noteworthy species of**

Eurya.—With Latin diagnoses. *J. Arnold Arbor.* 20, 1939 (361–74).

12.27.39 : 12.19.1 : 2 (54). Sen Gupta, J. N. ***Dipterocarpus* [Gurjan] forests in India, and their regeneration.** *Indian For. Rec.* [*n.s.*] *Silviculture* 3, 1939 (61–164). Manager of Publications, Delhi.

The importance of *Dipterocarpus* forests has been discussed and the 9 species of *gurjan*—which is a collective name for all—occurring in India (including the Andamans, but excluding Burma) have been mentioned with reference to their general habitat, distribution in recognized types of forest, and local occurrence. They exhibit important common silvicultural characters and behave somewhat similarly towards reproduction, except one or two, whose deviations have been mentioned. Results of experiments to date, giving definite indications, have been incorporated in suggesting proposals for different provinces as regards the future treatment of their potential *gurjan* forests, mainly from the point of view of natural and artificial regeneration with details of the technique so far evolved. *Author's summary*.

12.27.39 (91.4). Foxworthy, F. **Philippine Dipterocarpaceae. III.** Monographic paper with descriptions, keys, and general notes on the species at present known to occur. *Repr.* from *Philipp. J. Sci.* 67, 1938. (241–333).

Descriptions of and keys to the Philippine genera and species of the Dipterocarpaceae.

12.27.48–9 (91.4). Mendoza, D. R. **Fruit and seed key of important Philippine leguminous trees.** *Philipp. J. For.* 2, 1939 (161–9).

12.27.49 (67). Chevalier, A. **On a timber species of Cameroon and Gaboon (*Afzelia pachyloba* Harms).** *Rev. Bot. appl.* 19, 215, 1939 (484–8). [F.] P.R.

A. pachyloba and *A. zenkeri* are identical. Flowers and fruits are described and illustrated with drawings.

12.27.56(95). Exell, A. W. ***Combretaceae* of the 1936 Archbold Expedition [Fly River, British New Guinea].** *J. Arnold Arbor.* 20, 1939 (317–20).

12.27.57 (946). **The description of a new Eucalypt species.** *Pap. roy. Soc. Tasm.* 1938 (129–30).

The species *Eucalyptus morrisbyi*.

12.27.71. Francis, W. D. **Notes on the genus *Flindersia*, with keys for the determination of the rain-forest species.** *Repr.* from *Qd. agric. J.* Dept. of Agriculture and Stock, Queensland, Divn. of Plant Industry [Research], *Pamphlet* No. 56, 1938. pp. 4.

12.27.71 (47). Mat, I. S. **The cultivation of *Phellodendron amurense* Rupr. in the European part of the U.S.S.R.** *Lesnoe Khozyaystvo, Moscow* 7, 1939 (43–5). [R.]

Phellodendron amurense which, in mixture with other tree species, covers some 5,000,000 hectares in Eastern Siberia, has now been successfully acclimatized in various parts of European Russia.

12.27.71 : 01.2. Airy-Shaw, H. K. **Notes on the nomenclature of certain *Rutaceae-Aurantioideae*.** *Kew Bull.* 6, 1939 (290–3).

12.27.82. Nesterchuk, G. I. **On the polymorphism of *Euonymus verrucosa*.** *Sbornik Trudov Beresklet* 1938 (65–86). [R.e.] [The U.S.S.R. Central Forestry Research Institute, Leningrad.]

12.27.82 : 12.11.2. Stratonovitch, A. I. **The blossoming of *Euonymus verrucosa* and the ripening of its seeds.** *Sbornik Trudov Beresklet* 1938 (33–46). [R.e.] [The U.S.S.R. Central Forestry Research Institute, Leningrad.]

12.27.82 : 12.14 : 31. Stratonovitch, A. I. **The structure, productivity and gutta-percha content of *Euonymus verrucosa* Scop. under different ecological conditions.** *Sbornik Trudov Beresklet* 1938 (7–32). [R.e.] [The U.S.S.R. Central Forestry Research Institute, Leningrad.]

12.27.82 : 12.14.8. Shaternikova, A. N. **An anatomical study of gutta-percha reservoirs in the bark of *Euonymus verrucosa*.** *Sbornik Trudov Beresklet* 1938 (135–54). [R.e.] [The U.S.S.R. Central Forestry Research Institute, Leningrad.]

12.27.92 (95). Harms, H. **Enumeration of the Araliaceae collected by L. J. Brass in New Guinea.** *J. Arnold Arbor.* 20, 1939 (321–3).

12.28.61 : 21 : 3 : 57. Beversluis, J. R. Boschbouwkundige gegevens omtrent houtsoorten: *Fraxinus excelsior* L., gewone esch. [**Forestry data on timber trees: *Fraxinus excelsior***

L., Common Ash.] *Ned. Boschb.-Tijdschr.* 12, 1939 (112–15). [Du.]

13. FOREST ZOOLOGY

13.11. Physiology. Biology

13.11 : 13.15 : 12.28.47. CAMPBELL, W. G., and McGOWAN, J. C. **The composition and origin of a stony deposit found in galleries of the beehole borer [*Xyleutes ceramica* Wlk.] in a number of samples of Teak wood [*Tectona grandis* L.f.].** *Emp. For. J.* 18, 1939 (91–4).

The approximate composition of the deposit is 8 per cent. moisture, 55 per cent. resinous organic material, and 36 per cent. calcium hydrogen phosphate. The origin of the deposit is probably the tree sap from which water is evaporated.

13.15. Ecology. Habits. Adaptability

13.15. GRAHAM, S. A. **Forest insect populations.** *Ecol. Monogr.* 9, 1939 (301–10).

With particular reference to economically injurious forest insects of North America considered on the basis of population types as (*a*) balanced populations at high density, (*b*) sporadically eruptive populations, and (*c*) periodically eruptive populations. Specific examples of each type are discussed with some of the environmental factors that affect their population trends.

13.15 : 13.21.85.7 (66.9). NASH, T. A. M. **The ecology of the puparium of *Glossina* in Northern Nigeria.** *Bull. ent. Res.* 30, 1939 (259–84).

Forest vegetation is an important factor in the breeding and development of the tsetse fly.

13.15 : 12.25.53 : 12.26.22 : 47 (73). SAVELY, H. E. **Ecological relations of certain animals in dead Pine and Oak logs.** *Ecol. Monogr.* 9, 1939 (321–85).

13.2. *Special (Systematic) Zoology*

13.21.85 (71.4). GOBEIL, A. R. Les insectes forestiers du Québec en 1938. **[The forest insects of Quebec in 1938.]** *Bull. ent. Minist. Terres Québec* No. 3, 1939. pp. 48. [F.] R.A.E. A 27 (463–4).

An account is given of the first annual survey, in 1938, of the forest insect pests of the Province of Quebec. *Diprion polytomum* Htg., the most plentiful and most destructive pest of Spruce, represented 67 per cent. of all the insects taken. The most serious pest of Larch was *Pristiphora* (*Nematus*) *erichsonii* Htg., which seemed likely to kill a considerable number of trees, particularly in the Abitibi district. Other insects recorded during the survey include *Pikonema alaskensis* Rohw., *P. dimmocki* Cress., *Peronea variana* Fern., *Diprion* (*Neodiprion*) *abietis* Harr., *D.* (*N.*) *lecontei* Fitch, *D.* (*N.*) *pinetum* Norton, *Ellopia fiscellaria* Gn., *Hemerocampa leucostigma* S. & A., *Pissodes strobi* Peck, and *Marlattia laricis* Marl.

13.21.85.5 (73). KNIGHT, H. H. ***Reuteria* Puton; four new species from the United States [*Hemiptera Miridae*].** *Iowa St. Coll. J. Sci.* 13, 1939 (129–33).

Found mainly in the north central, northeastern, and eastern states. *Reuteria irrorata* is found on *Ulmus americana*, *Reuteria fuscornis* on *Ostrya virginiana* and *Carpinus caroliniana*, and *Reuteria querci* on Oak, particularly *Quercus macrocarpa*.

13.21.85.53.4 : 12.25.51 (52.4). KONO, H., and INOUYE, M. Eine neue Art von Aphididen, schädlich an Sachalintannen. **[A new species of aphid, injurious to *Abies sachalinensis*].** *Insecta matsum.* 13, 1938 (41–3). R.A.E. A 27 (339).

The winged viviparous female of *Cinara hattorii* sp. nov. is described. It is found on the trunks and thick branches of *Abies sachalinensis* in Hokkaido.

13.21.85.53.42 (494). SCHNEIDER-ORELLI, O. **On the advance made by *Dreyfusia nüsslini* in the selection-forest district of Vorderarni.** *Schweiz. Z. Forstw.* 90, 1939 (205–9). [G.]

Description of damage. It is suggested that investigations should be made in order to ascertain if young larvae can be transported by strong winds.

13.21.85.53.42 (494.3). SIEBENMANN. **On the outbreak of *Dreyfusia nüsslini* in the State forests of Zofingen.** *Schweiz. Z. Forstw.* 90, 1939 (190–2). [G.]

13.21.85.6. GEISTHARDT, G. **A misunderstood injury to forest plantations, caused by larvae of *Polyphylla fullo* L.** *Forstarchiv* 15, 1939 (243–6). [G.]

The damage was at first attributed to mice.

13.21.85.65.12 (52). KÔNO, H. Die Rhizophagiden im Tannen- und Fichtenwald in Japan. [**The genus *Rhizophagus* in Fir and Spruce forests in Japan.**] *Insecta matsum.* 13, 1938 (45–6). R.A.E. A 27 (339).

Adults and larvae of *Rhizophagus* species are known to be predacious on scolytid beetles. The paper records various species found in association with scolytids in Japanese forests.

13.21.85.65.21 : 45.3 (931). CLARK, A. F. **The occurrence of the golden buprestid (*Buprestis aurulenta* L.) in New Zealand.** *N.Z.J. Sci. Tech.* (B) 20, 1938 (119B–20B), R.A.E. A 27 (329).

An adult of the American buprestid, *Buprestis aurulenta* L., was caught near Auckland in 1937. As it is believed that the larvae of this species are particularly attracted to exposed pitchy wood, its establishment in New Zealand may become significantly related with the green pruning of conifers, which is now undertaken in some exotic forests.

13.21.85.65.42 : 13.15. ECKSTEIN, K. **The dust produced by the boring of Anobiid beetles.** *Forstarchiv* 15, 1939 (268–71). [G.]

13.21.85.67.1 : 31.43.2. STEINER, P. **Efficacy tests of insecticides for *Hylotrupes bajulus*.** *Anz. Schädlingsk.* 15, 1939 (49–51). [G.]

Arrangement of biological efficacy tests discussed with reference to recent investigations on 'Xylamon-LX-Natur'.

13.21.85.67.1 : 31.43.2 (54). SAALAS, U. *Stromatium barbatum* Fabr. toukan [Col., *Cerambycidae*] kulkeutuminen Intiasta Suomeen vanerilaudan kappaleessa. [**A larva of *S. barbatum* in a piece of plywood in Finland from India.**] *Ann. ent. fenn.* 5, 1939 (41–7). [Fi.g.] R.A.E. A 27 (465).

Several tea chests, made in India from Birch plywood exported from Finland, were found on their arrival in London in March 1936, to be injured and to be infested with large larvae. From a sample of the infested plywood sent to Finland the author bred out, in October 1938, *Stromatium barbatum* F., a Cerambycid that occurs only in the region of the Indian Ocean. Injury in 1934 to Finnish plywood similarly imported into India had been caused by a South Asiatic Buprestid of the genus *Chrysochroa* (*Catoxantha*).

13.21.85.68 : 45.3 : 12.26.22 : 47 (497.1). HERGULA, B. **The 'secondary' character of the bark- and wood-boring beetles of Oaks in Jugoslavia.** *Ann. Exp. for., Zagreb.* 6, 1938 (280–318). [Serb.g.] Stamparija Gutenberg, Zagreb, Jugoslavia.

13.21.85.68.3 : 31.43.2 (47.88). PARFENT'EV, V. YA. ***Rhyncolus culinaris* Germ. in the Volga Region.** *Plant Protection* [*Leningrad*] No. 17, 1938 (132–4). [R.] R.A.E. A 27 (321–2).

Serious damage has been done by *Rhyncolus culinaris* to the timbers of buildings in settlements along the Volga. The source of infestation was wood from ruined houses, which was carried in barges during the civil war and stored for fuel. The weevil still occurs in wood borne by spring floods, which is also used for fuel. Its attacks are made chiefly on wood that periodically becomes very damp, and infestation is heaviest in the exposed ends of beams. Only sapwood is attacked, hence the degree of damage depends partly on the thickness of the timbers. Portions of beams may be very severely damaged, and the injury is sometimes intensified as a result of simultaneous attack by *Anobium punctatum* De G. (*striatum* Ol.) or *Trypopitys* (*Priobium*) *carpini* Hbst. Both adults and larvae of *Rhyncolus culinaris* are capable of hibernating.

13.21.85.68.3 : 12.25.53 : 13.15 : 47 (498). MARCU, O. Beiträge zur Kenntnis der Ökologie und Verbreitung einiger Kieferschädlinge [*Brachonyx pineti* Payk. und *Anthonomus varians* Payk.] in Rumänien. [**Contributions to the knowledge of the ecology and distribution of certain pests of Pine [*B. pineti* and *A. varians*] in Rumania.**] *Bul. Fac. Şti. Cernauti* 8, 1935 (179–83). R.A.E. A 27 (355).

Brachonyx pineti Payk. and its variety *obscurella* Pic. are widespread on *Pinus sylvestris* var. *hamata* in Rumania. The larvae tunnel in the needles and the adults feed on the epidermis of the needles. Young Pines are seriously injured by the larvae; the needles become discoloured, and if severe attack continues for several years the trees die. The only method of control available is the collection of infested needles in June and early July, before the emergence of the adults. Slight injury is caused to old trees of *Pinus sylvestris* var. *turfosa* by *Anthonomus varians* Payk. the larvae of which feed on the pollen, and the adults on the needles.

13.21.85.68.4–5. SCHEDL, K. E. *Scolytidae* und *Platypodidae*: 1. Zur Synonymie der Bor-

kenkäfer. 2. Neue Gattungen und Arten. [*Scolytidae* and *Platypodidae*: **1. On the synonymy of the bark beetles. 2. New genera and species.**] *Rev. Zool. Bot. afr.* 32 1939 (379–87). [G.]

13.21.85.68.4 : 13.11.6 (74.4). BECKER, W. B. **Larval development of the native Elm bark beetle [*Hylurgopinus rufipes* Eich.] in Massachusetts.** *J. econ. Ent.* 32, 1939 (112–21).

13.21.85.68.4 : 13.15 : 13.16 (91). BROWNE, F. G. **The Chengal seed-beetle, *Coccotrypes graniceps* Eich.** [*Coleoptera—Scolytidae.*] *Malay. Forester* 8, 1939 (107–15)

The developmental stages of *Coccotrypes graniceps* Eich. are described, and the habits, life-cycle, and economic importance of the species are discussed. *Author's summary.*

13.21.85.5. CAMERON, E. **The Holly leaf-miner (*Phytomyza ilicis* Curt.) and its parasites.** *Bull. ent. Res.* 30, 1939 (173–208).

13.21.85.8 (45). CANZANELLI, A. **The insect fauna of our forests. I. Procession moths.** *Riv. for. ital.* 1, 1939 (47–52). [It.]

13.21.85.8 (498). ELIESCU, G. **Notes on some insect pests of Rumanian forests.** *Rev. Pădurilor* 51, 1939 (487–96). [Rou.f.]

Description of damage caused in the Oak forests of the Rumanian plain by *Cheimatobia brumata* L., *Tortrix viridana* L., and *Malacosoma neustria* L.

13.21.85.8 (51.1). MIAO, C. P. **Study of some forest insects of Nanking and its vicinity. Pt. 1.** *Contr. biol. Lab. Sci. Soc. China* (*Zool.*) 12, 1937 (131–81). R.A.E. A 27 (360).

Detailed descriptions are given of all stages and larval instars of three Lepidoptera attacking forest trees in the district of Nanking, together with brief notes on their bionomics. They are the Lasiocampids *Lebeda nobilis* Wlk. and *Pyrosis* (*Bhima*) *idiota* Graes., which are polyphagous but particularly injurious to Oaks, and *Papilio xuthus* L., which attacks *Zanthoxylum* spp. and *Poncirus trifoliata.*

13.21.85.82.1 : 13.11. SCHWERDTFEGER, F. **On the critical number of eggs and egg parasitization in the Pine looper moth, *Bupalus piniarius* L.** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (123–6). [G.]

13.21.85.82.1 : 13.11 : 13.14. STAHL, G. **On the relations between the diameter, weight, and volume of pupae, and the number of eggs in the Pine looper moth, *Bupalus piniarius* L.** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (113–23). [G.]

13.21.85.82.1 : 13.11 : 13.14. SCHEU, G. **Methods of research on pupae in connexion with the prediction of Pine looper moth epidemics.** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (106–12). [G.g.]

13.21.85.82.1 : 13.11. MÜLLER, H. and SCHEU, G. **On the effect of packing and storing the collected pupae of the Pine looper moth upon the result of the investigation into their state of health.** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (99–105). [G.]

13.21.85.82.1 : 13.11. HOUTERMANS, P. **An experiment to determine the error in sampling for pupae of the Pine looper moth.** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (96–9). [G.]

13.21.85.82.1 : 13.15. HOUTERMANS, P. **Research on the distribution in the stand of pupae of the Pine looper moth [*Bupalus piniarius* L.].** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (75–95). [G.g.]

13.21.85.82.1 : 13.15. THALENHORST, W. **On the occurrence of *Ichneumon nigritarius* Grav. as a parasite of the Pine looper moth and other *Lepidoptera*.** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (65–74). [G.g.]

13.21.85.82.1 : 13.11. ENGEL, H. **Notes on the biology of the Pine looper moth [*Bupalus piniarius* L.].** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (51–64). [G.]

13.21.85.82.1 : 13.15. SUBKLEW, W. **Research on population movements of the Pine looper moth [*Bupalus piniarius* L.].** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (10–51). [G.]

13.21.85.82.1 (43.1). STAHL, G. **The progress and extension of the Pine looper moth epidemic in Prussia during 1937.** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (9). [G.]

13.21.85.91.1 : 13.11. KOLUBAJIV, S. **On the biology of the Spruce sawflies *Lygaeonematus pini* Retz and *Pachynematus montanus* Zadd.** *Lesnická Práce* 18, 1939 (317–38). [Cz.g.f.e.]

13.21.85.91.2. HUBAULT, E. Les champignons des *Sirex*. **[Fungi of *Sirex* woodwasps.]** *Rev. Eaux. For.* 77, 1939 (620–4). [F.]

13.21.85.91.3 : 45.3 (43). THALENHORST, W. Ergebnisse einer Zucht von *Meteorus versicolor* Wesm. [*Hymenoptera: Braconidae*]. **[Results of breeding *M. versicolor*.]** *Arb. physiol. angew. Ent. Berl.* 6, 1939 (73–5). R.A.E. A 27 (354).

Laboratory breeding experiments suggest that, at least in some parts of Germany, *Meteorus versicolor* may produce two generations a year, the first parasitic on larvae of *Panolis flammea* Schiff., and the second on larvae of *Dendrolimus pini* L.

13.21.85.91.3 : 13.21.85.65.42(75.9). MUESEBECK, C. F. W. **A new species of Heterospilus parasitic on an injurious Anobiid [*Hymenoptera: Braconidae*].** *Proc. ent. Soc. Wash.* 41, 1939 (62–3). R.A.E. A 27 (461).

The Braconid, *Heterospilus anobiidivorus* sp. n., is described from two females reared from the Anobiid, *Neogastrallus librinocens* Fisher, in Florida.

2. SILVICULTURE

2 : 09.7(491). HANSEN, K. Nogle Oplysninger om Skovvæsenet paa Island **[Notes on forestry in Iceland].** *Dansk Skovforen. Tidsskr.* 1939 [229–37]. [Da.]

The natural woods of Iceland cover about 600 sq. km., or just under 4·3 per cent. of the total land area. They consist of patches of dense, low Birch scrub. The scrubby habit is accounted for mainly by long-continued and unrestricted browsing by domestic animals: in some places fencing has brought about striking improvement, though in most areas the scrub has been so damaged that fencing would be ineffective unless accompanied by regenerative measures. Clear strip felling should be effective, since the Iceland Birch has a great capacity for vegetative reproduction. Attempts have been made to raise new woods, including plantations of exotic trees, of which an optimistic report has recently been published. The author's own long experience in Iceland has convinced him that it is impossible or unprofitable to raise exotic plantations there. The chief reason for the poor growth of such plantations is the loess soil, into which rain-water penetrates very little and often evaporates almost as soon as the rain has stopped. Some improvement can be made by deep digging and manuring, but such measures are far too costly. Frost lift is also severe in this soil and renders planting almost useless. Experiments on the sowing of Birch, however, have given good results, and a promising technique has been employed whereby only the surface of the turf is removed, thus exposing the fibrous hygroscopic sod into which the seeds are stamped. The nature of this seedbed prevents frost lift and aids in the conservation of moisture.

2 : 09.7 : 12.26.22 (498). FRÖHLICH, J. **The Oak problem in the Siebenbürgen district of Rumania.** *Forstwiss. Cbl.* 61, 1939 (422–8). [G.]

A criticism of the past management of the 1·5 million hectares of Rumania's Oak forests, which resulted in clear cutting large areas with inadequate provision for regeneration. Artificial regeneration, mainly from seed, is advocated, but it is pointed out that the present administrative units are too large to permit intensive silvicultural operations.

21. SILVICULTURAL CHARACTERS

21.1–2 : 11.15 : 11.11.4. MOSHKOV, B. S. **Relationship between photoperiodism and drought resistance of perennial plants.** *C.R. Acad. Sci. U.R.S.S.* 22, 1939 (184–6). [R.]

Experimental evidence of a definite relationship from investigation on the species *Prunus besseyi* and *Robinia pseudacacia* and also the evergreen plants lemon and tea.

21.1 : 11.11.2 : 12.25.5 (943). CROMER, D. A. N. **Frost resistance of Bunya Pine.** *Aust. For.* 4, 1939 (39–40).

Bunya Pine (*Araucaria bidwillii*), which is a sub-tropical tree found only in South Queensland, appears to be entirely unaffected by temperatures down to 23° F. and at 21° F. reacts with the whitening of a few lateral shoots. Eighteen-month seedlings that had been tubed for several months were used in these experiments.

21.2 : 12.11.14 : 12.25.53. SCHOPMEYER, C. S. **Transpiration and physico-chemical pro-**

perties of leaves as related to drought resistance in Loblolly Pine and Shortleaf Pine. *Plant Physiol.* 14, 1939 (447–62). [N. Rocky Mt. Forest and Range Exp. Sta.] O.B.D.

Determinations of transpiration, bound water, total water, and osmotic pressure were made on seedlings of Loblolly Pine (*Pinus taeda* L.) and Shortleaf Pine (*P. echinata* Mill.) to obtain information on the behaviour of these species during and after drought and to ascertain whether any of these factors can be used as indicators of drought resistance. Solute concentration, calculated from data on osmotic pressure and total water content, was a valuable aid in interpreting the osmotic pressure differences. Points that may contribute to the greater drought resistance of Shortleaf Pine as compared with Loblolly Pine were: (1) Shortleaf Pine absorbed more water from the soil and at the same time maintained a higher total water content in its leaves, even when soil moisture was limited; and (2) Shortleaf Pine maintained a higher solute concentration when recovering from the effects of drought (i.e. when 30 per cent. soil moisture was restored after having been reduced to the wilting coefficient). The data also show that the greater drought resistance of Shortleaf Pine cannot be attributed to an ability to conserve water either by retarding transpiration or by forming bound water; neither can it be attributed to a higher osmotic pressure. *From author's summary.*

21.2 : 12.11.1 : 11.41.33 : 12.25.53. Pessin, L. J. **Effect of soil moisture on the rate of growth of Longleaf and Slash Pine seedlings.** *Plant Physiol.* 13, 1938 (179–89). [Southern Forest Exp. Sta., New Orleans.] O.B.D.

Seedlings of Longleaf Pine (*Pinus palustris* Mill.) and Slash Pine (*P. caribaea* Morelet) were grown on a standard soil under different moisture conditions, the deficit from transpiration being restored at frequent intervals. In their first growing season seedlings of Longleaf Pine grew best on moist soil (soil with an initial moisture content of about 25 per cent. by weight); Slash Pine was less exacting and showed no significant differences in growth on soils with initial moisture contents of 15 to 25 per cent. Both species survived well but grew poorly under extremes of dryness or wetness; in both the transpiration rates were similar and varied with the soil moisture provided. Under moist to wet conditions the water requirement of Slash Pine was higher than that of Longleaf Pine; indicating that the former requires more moisture to form a unit of dry matter than does the latter. In both species the formation of mycorrhiza was most abundant under moist conditions (about 25 per cent. soil moisture) and the mycorrhizal seedlings were particularly vigorous in appearance. The results of the investigation, showing that both species, though tolerating wide extremes of soil moisture, grow best on moist soils where drainage is neither too rapid nor too slow, are in agreement with practical experience of the seedlings under natural conditions in the field and have also a direct bearing upon future nursery practice.

21.2–3 : 11.11.4 : 12.25.53. Shirley, H. L., and Meuli, L. J. **The influence of soil nutrients on drought resistance of two-year-old Red Pine.** *Amer. J. Bot.* 26, 1939 (355–60). [Lake States Forest Exp. Sta.] O.B.D.

Nursery and pot cultures of *Pinus resinosa* seedlings in their second growing season were supplied with various amounts of nitrogen, phosphate, and water. At the end of the season tests were carried out in 'drought machines' under controlled conditions. Drought resistance was assessed in the pot cultures by the moisture content of seedlings after 3 days' exposure to drought; in the nursery cultures the length of survival under drought conditions was taken as an index. Both types of culture showed that drought resistance regularly fell with increase in the nitrogen supply. The effect of phosphate supply varied with the amount of nitrogen present. If nitrogen was absent, increase in the phosphate supply gave improved drought resistance; in the presence of nitrogen the same tendency was noticeable, but the optimum P : N ratio was not determined. The influence of phosphate supply was not statistically significant in the nursery cultures owing probably to an adequate natural supply. No demonstrable effect of the watering régime could be found in the pot cultures; in the nursery, however, plants watered daily were less resistant than those watered at 3-day intervals if nitrogen was absent. When nitrogen was supplied the effect was masked, probably because heavy watering would leach out nitrogen from the soil and thus favour the heavily watered seedlings to some extent. In both series of tests small seedlings appeared to be more resistant than large, but even after correction for size, the order of results of different

treatments remained unaltered. The ratio of root to top showed only a rough correlation with drought resistance. The investigation shows that resistance depends upon a balance of nutrients as well as upon the concentration of nitrogen alone; further research is therefore needed to determine the optimum nutrient régime for producing plants that are at the same time normal-sized and drought-resistant.

21.2–3 : 11.11.4 : 42.22 : 12.25.53 (77). SHIRLEY, H. L., and MEULI, L. J. **Influence of moisture supply on drought resistance of conifers.** *J. agric. Res.* 59, 1939 (1–21). [Lake States Forest Exp. Sta., St. Paul, Minn.] O.R.E.

As a result of tests made in a newly improved artificial drought machine, it was determined that the drought resistance of seedlings of Red Pine (*Pinus resinosa*), Northern White Pine (*P. strobus*), and Jack Pine (*P. banksiana*), from the Lake States, was increased by subjecting the seedlings to moderate soil drought during the period of vegetative activity. In general this treatment resulted in greater development of roots in proportion to top, and in smaller size of tops, although improved resistance did not depend entirely on these factors.

Resistance built up in Red Pine through controlled watering during the second year in the nursery persisted to a significant degree during the following season. Exposure to severe dryness of soil temporarily weakened the plants, and unless followed by an ample period of recovery, rendered them more susceptible to drought. Improvement of drought resistance of Lake States Pine seedlings by controlling the moisture supply in the nursery was demonstrated to be a practical procedure which can be applied in large forest nurseries. *From author's summary.*

21.4 : 12.11 : 12.14.3 : 12.15.6 (489). LADEFOGED, K. Untersuchungen über die Periodizität im Ausbruch und Längenwachstum der Wurzeln bei einigen unseren gewöhnlichsten Waldbäume [**Investigations on periodicity in the production and longitudinal growth of roots in some of our commonest forest trees**]. *Forstl. Forsøgsv. Danm.* 16, 1939 (1–256). [G.da.]

Root growth was investigated with reference to the periods of activity and dormancy under forest conditions, the course of growth during the active period, the relation between external and internal factors, and the individual behaviour of the various species on different soils. The investigation included research on the seasonal moisture content and temperature of forest soils, on the periodicity of root growth in relation to these factors, and supplementary laboratory experiments. Beech in the forest showed root growth throughout the year; Ash, Alder, Birch, Spruce, Silver Fir, and Larch underwent dormant periods of various length during the coldest months, although the winters during the investigation were rather mild. Factors influencing periodicity were the climatic conditions of each particular year, microclimate and situation, and the nature of the soil, particularly its water and oxygen contents. Shelter and warmth extended the length of the growing season, growth starting earlier and finishing later in warm springs and autumns and under sheltered conditions. Trees of the same species behaved similarly on sandy, clayey, or humus soils provided that drainage was good; on such soils the time of initiation and cessation of root growth and the corresponding mean soil temperatures were as follows: Ash: May (8–9° C.)—first half of November (6–8° C.); Alder: last half of May (8–9° C.)—last half of November (6–7° C.); Spruce: first half of April (4–5° C.)—last half of November (6–7° C.); Silver Fir: first half of April (4·6° C.)—some time during the following January; Larch: last half of April (5·7° C.)—last half of November (6·1° C.). On wet, poorly drained peat soils the active period was extremely short, presumably on account of the presence of stagnant oxygen-deficient ground water over most of the year. The dates of initiation and cessation of root growth were:—Ash: first half of August—first half of November; and Birch: first half of June (at soil temperature of 11·2° C.)—first half of November (at 8·2° C.). The above data relate to mature trees: young trees proved much more dependent upon soil moisture and much more susceptible to fluctuations in moisture by reason of their imperfectly developed root system. General data on periodicity cannot be given, since the periods vary too widely from place to place and from year to year. The results obtained are compared with the findings of previous workers and it is pointed out that the divergencies between certain of the results indicate that the external factors of the habitat must play a major part in comparison with the internal factors of the plants themselves. The dependence of periodicity upon external factors seems

to decrease by species in the following order: Beech, Silver Fir, Ash, Birch, Alder, Spruce, Larch. During the period of root activity, growth was closely correlated with soil temperature and moisture. Maximum root growth coincided on the relatively well-drained soils with the rainy periods in summer. In dry summer periods growth was most seriously retarded in stiff clay soils, and soils in exposed places. Trees on badly drained peat soils, however, showed maximum root growth during the drought periods, presumably on account of the retreat of ground water and the greater access to oxygen. The formation of short roots and of root hairs was also studied, and a section is devoted to the complicated question of relations between root and shoot development. The laboratory experiments confirm in the main the dependence of root development upon temperature and reflect to a large extent the different behaviour of the separate species in the field. It was established that the optimum soil temperatures for root growth under adequate moisture conditions are considerably higher than those reached in nature, except in exposed places on very hot days. Experiments were also made on the relation of root growth to soil moisture, but it is emphasized that the results cannot be applied directly to natural conditions, since the behaviour of trees in the forest is influenced by the form and depth of the root system as a whole, so that shallow rooters that are naturally more tolerant of water deficiency may actually appear less so in comparison with deep-rooted but physiologically less resistant species. The investigations are fully described and the results compared in detail with those of previous workers.

21.6 : 24.25 : 24.5 : 6 : 12.25.53 (487.3). Bundy, O. Undersökning över tallens naturliga kvistrensning inom Södermanlands län. [**Research on the self-pruning of Scots Pine in Södermanland.**] *Skogsägaren* 15, 1939 (118–22). [Sw.]

It was found that to obtain a clear bole the annual rings at breast height must be kept below 1·3 mm. in breadth until self-pruning has taken place to the desired height; this means that the breast-height diameter in centimetres must not exceed the height of the tree in metres. To secure self-pruning by keeping the stand dense entails a sacrifice of diameter increment that varies directly with the quality of the site. Silvicultural practice and management should therefore be adjusted in accordance with the economics of raising particular types of timber and their particular marketing and price conditions.

21.6 : 32.1 : 5–6 (78). Hornibrook, E. M. **A modified tree classification for use in growth studies and timber marking in Black Hills Ponderosa Pine.** *J. For.* 37, 1939 (483–8). [Rocky Mt. Forest and Range Exp. Sta., Colorado.]

A modification of Keen's tree classification recognizing four age groups each divided into four vigour classes. These are described and illustrated and some suggestions are given for the application of the system to timber marking.

A study was made of the diameter increment of 20 trees in each age and vigour class over a 25-year period for both uncut and selectively cut stands, and it was determined that the mean difference in diameter growth between age classes and between vigour classes is highly significant. In general, the acceleration in diameter growth rate, due to release following selection cutting, was equivalent, in uncut stands, to the difference in growth rate of two contiguous age classes of the same vigour class.

22. SYSTEMS OF MANAGEMENT. FORMS OF STAND

22.15.1 : 12.25.53 (43.4.1). Baader, G. **The Pine high-forest-with-standards system in the Eberstadt Forest District, Hesse: Pt. II. The behaviour of the standards.** *Allg. Forst- und Jagdztg.* 115, 1939 (141–8). [G.g.]

Standards, as compared with similar trees in even-aged high forests, have more voluminous crowns, put on more diameter and volume increment, and have a considerably thinner bark, but they are slightly inferior in height and stem form. Standards that are more than 100 years old will not respond to release cutting, and those of younger age classes will cease to put on superior diameter increment about 60 years after they have been set free.

22.16. Lemmel, H. Die Organismusidee in Möllers Dauerwaldgedanken. [**The 'organism idea' in Möller's conception of Dauerwald.**] Julius Springer, Berlin. 1939. pp. 192.

22.21 (44.38). Toussaint, E. **Coppice with standards on rich soil in the plain of Alsace: treatment and produce.** *Rev. Eaux For.* 77, 1939 (197–212). [F.]

Fire-wood production is still the main object of management owing to a relatively good local market. Nevertheless, the forests are gradually losing their classical coppice-with-standards character and even-aged plantations are being created in blanks.

23. FORMATION OF STANDS

23 : 12.25.53 (71). CANDY, R. H. **Discussion on the reproduction and development of White Pine.** *For. Chron.* 15, 1939 (88–92).

White Pine has disappeared from many parts of central and eastern Canada, and is now restricted largely to dry sand or gravelly sites. Natural agencies and logging practice are both responsible for this condition. The future development of this species is important and the various factors that may affect its reproduction and growth, favourable or otherwise, are discussed.

23 : 24 : 5 (74.7). COPE, J. A. **A hardwood record.** *J. For.* 37, 1939 (495–7). [Cornell University.]

In Munroe County, New York, a 20-year-old mixed hardwood stand (Red Oak, White Ash, White Elm, Basswood, &c.) of 2,900 cu. ft. per acre was established on a loam soil following the clear-cutting of a similar stand for fuelwood. Reproduction originated from seed in all cases except Basswood. A heavy thinning from above was made in the fall of 1938.

23.1. *Natural Formation of Stands*

23.1 : 12.25.51 (45.4). MONTANELLI, L. G. **Natural regeneration of Silver Fir in the Emilian Apennines.** *Riv. for. ital.* 1, 1939 (9–23). [It.]

Past and present distribution of the Silver Fir. Edaphic and climatic conditions of the region are discussed. In the higher elevations natural regeneration is excellent and pure forests are found.

23.1 : 12.27.57 (945). LAWRENCE, A. O. **Notes on *Eucalyptus obliqua* [Messmate] regrowth forests in Central Victoria.** *Aust. For.* 4, 1939 (4–10).

This species has a relatively wide distribution and the wood has a great variety of uses. There are probably no virgin stands of this species remaining in Central Victoria. Regrowth stands are of varying ages up to about 65 years and in some cases have reached the third and fourth rotation. Few seedlings are produced under a full canopy but prolific regeneration both of seedlings and coppice appears after logging, and seedling regeneration is particularly heavy after burning. Factors favourable to seedling establishment appear to be exposure of mineral soil, lack of root competition, and plenty of direct light. The fruit is heat resistant and it is probable that the seed supply is derived from either felled or standing trees after logging and fire, rather than from the forest floor. Regeneration is particularly plentiful on moist, rich sites.

This species appears to be relatively tolerant, grows vigorously in dense stands of seedlings and coppice, and, unless overtopped and suppressed, it shows rapid height growth and apical crown development unless or until site conditions become limiting. The crowns become rounded and spreading after the pole-wood stage is passed, and competition becomes intense in crowded stands. In its mature stage the tree becomes intolerant of mechanical interference, and while site conditions will determine the development of the stand as a whole, it is the inherent ability of individual trees to overcome and resist suppression that determines the rate of growth of the dominant final crop trees in the natural stand.

23.1 : 21 : 11.46.6 : 12.25.53 (76.2). WAHLENBERG, W. G., GREENE, S. W., and REED, H. R. **Effects of fire and cattle grazing on Longleaf Pine lands as studied at McNeill, Mississippi.** *Tech. Bull. U.S. Dep. Agric.* No. 683. Supt. of Documents, Washington, D.C. 1939. pp. 52.

Report on investigations during 1923–35 on the separate and combined effects of annual burning and grazing on survival and growth of Longleaf Pine, production of forage, and soil conditions. Annual winter burning (of uncontrolled intensity) improved the forage conditions for cattle. Regular burning and/or grazing made the survival of seedlings practically impossible, but even where fire and/or grazing were excluded completely, the seedlings were stunted and did not get out of the grass stage. This was probably due to a local epidemic of brown spot needle disease. Burning and grazing did not result in serious soil deterioration.

23.1 : 24.36 : 12.27.39 (91). DURANT, C. L. **Further notes on the regeneration of the heavy Dipterocarp hardwoods.** *Malay. Forester* 8, 1939 (103–7).

Complete removal of the overhead canopy is apparently not detrimental to seedling regeneration of the heavy-wooded species of *Shorea*. The heavy wingless seed and susceptibility to the shoot borer make such treatment impracticable for the species Chengal (*Balanocarpus heinii*). Although Chengal seedlings will persist for a long time under dense shade it is known that direct overhead light is necessary for rapid growth. It is concluded that the most satisfactory method for regenerating this species is 'timber felling followed by cleanings round the gaps with girdling to break the lower stories'. This should not be completed in one operation and will necessarily be followed by cleanings at regular intervals.

23.1 : 32.2 (47). MIKHEEV, S. D. **Natural regeneration on felled plots after tractor logging.** *Lesnoe Khozyaystvo, Moscow* 7, 1939 (27–30). [R.]

Preliminary results of sample plot experiments, 1936–9. The clear-cut areas investigated ranged in size from 3 to 5 hectares. No seed-bearers had been left on these plots so that new regeneration could be expected only from the seed of neighbouring stands. The forests were 100 to 120 years old and had a standing volume of 200 to 280 cubic metres per hectare. The strongly podsolized soil was sandy in the Pine-Red Bilberry type and sandy to loam in the Spruce and Pine-Blackberry type. Extraction had taken place in summer, and the timber was dragged in bundles. On the average, the soil had been disturbed in about 15 per cent. of the total extraction area. The disturbance was associated with a destruction of 90 to 100 per cent. of both ground vegetation and regeneration. In half of the disturbed area the podsolized horizon had been laid bare. New regeneration, i.e. that which had appeared after extraction, was 3 to 10 times more numerous in 4/5 of the disturbed area than between the tracks, but owing to the lack of seed bearers this was insufficient to compensate for the regeneration destroyed during extraction. The new regeneration on tracks appeared to be as viable as elsewhere.

23.11 : 12.25.52(71.3). MILLAR, J. B. **Spruce regeneration in Northern Ontario.** *For. Chron.* 15, 1939 (93–6).

Based on a study of Black Spruce in pure and mixed stands in the Great Clay Belt of Ontario. It is suggested that the best Black Spruce stands are established following fire and that the source of the seed is the standing fire-killed tree rather than the duff. Pure Spruce regeneration follows fire in Spruce swamps and merchantable muskegs, and Spruce with Balsam Fir and hardwoods follows fire on well-drained sites. However Spruce regeneration is absent after fire in cut-over areas and young stands. Raising the diameter limit for Black Spruce, and the cutting and utilization of Poplar for pulpwood are two methods suggested for promoting Spruce regeneration following the cutting of mixed forests. Strip cutting is being tried as a means of improving the chances of regeneration in pure even-aged Black Spruce swamps.

23.13 : 32.2 : 43.1 (71.3). WALKOM, H. C. **Some suggested methods of logging to improve natural regeneration in the clay belt.** *For. Chron.* 15, 1939 (103–6).

Modifications in methods of cutting and hauling that may improve the chances of survival of advance growth and establishment of reproduction after logging in the Clay Belt in Ontario. Most of these refinements add something to the cost of operating but this should be justified. Protection against fire and insects is essential at all times. Measures that should be used in prevention of fire are listed.

23.2. *Artificial Formation of Stands. Artificial Regeneration*

23.2–3 : 12.25.53 (44.2). SERRE, M. DE LA. **The technique of afforestation with Pines in the West of France.** *Rev. Eaux For.* 77, 1939 (325–34). [F.f.]

Methods of sowing and planting adopted in Normandy.

23.2 : 12.26.41 (44.49). VACHAT, F. DU. **Plantations of Poplar in the marsh of La Chautagne.** *Rev. Eaux For.* 77, 1939 (306–17, 403–13). [F.]

A report on afforestation with Canadian Poplar var. *angulata cordata robusta* and the allied Swiss variety (peuplier suisse régénéré). Mixture with *Alnus glutinosa* had a favourable influence on the diameter growth of the young Poplars, although the soil was by no means deficient in nitrogen. The paper contains a detailed financial forecast according to which a fairly high rate of interest on the invested capital may be expected.

23.2 : 12.27.49. TONDEUR, G. ***Cassia siamea* Lam., a tree for reforestation work.** *Bull. agric. Congo belge* 30, 1939 (249–57). [F.]

Cassia siamea is a valuable nurse species and is of use in soil improvement. It furnishes excellent firewood, and, not being exacting in site requirements, it makes a good tree for native afforestation work. The author outlines the requirements of the species and describes the technique for its propagation by sowing and stump-planting.

23.21. Choice of Species

23.21.6 : 12.11.3 : 12.25.53 (43.46). GUDDEN, F. **Report on an investigation of races of Murray Pine in the Wildtal Instructional Forest in the State Forest District of Freiburg im Breisgau.** *Allg. Forst- u. Jagdztg.* 115, 1939 (162–4). [G.]

Type 'O' (seed origin: 700 m. elevation, period without frosts May 15–August 15) and type 'U' (seed origin: 1,000 m. elevation, period without frosts May 31–July 31), both from the western slopes of the Cascade Range, showed better early growth to the age of 6 years than the fast-growing local Scots Pines, and also proved much more resistant to snowbreak.

23.23. Sowings. Seed Planting

23.23.15 : 12.25.5. ROHMEDER, E. **Curing arrested germination in seeds of Weymouth Pine, Douglas Fir, and Larch by pretreatment under cold and wet conditions.** *Forstwiss. Cbl.* 61, 1939 (393–406). [G.]

The experiments conducted at the Forstliche Samenprüfstelle at Munich confirmed the value of the pre-treatment of Weymouth Pine seed on the lines developed by Schwappach, Grisch, Lakon, and Koblet. Except in the case of very poorly germinating samples, the rate and percentage of germination was greatly increased by moist storage at 2° to 4° C. for 28 days. The method proved ineffective for Larch and Douglas Fir seed.

23.23.15 : 12.27.82. STRATONOVITCH, A. I. **The treatment of *Euonymus verrucosa* seeds previous to sowing.** *Sbornik Trudov Beresklet* 1938 (47–64). [R.e.] [The U.S.S.R. Central Forestry Research Institute, Leningrad.]

23.23.15 : 12.25.53 (76). NELSON, M. L. **Preliminary investigations on dry cold storage of southern Pine seed.** U.S.D.A. Forest Service. *Southern Forest Exp. Sta. Occ. Pap.* No. 78. 1938. pp. 19.

Preliminary investigations indicate that a reduction in seed moisture content, by methods not harmful in themselves, is beneficial for the retention of viability, particularly for the species Longleaf, Slash, Loblolly, and Shortleaf Pine, and that seed deterioration is reduced with storage at low temperatures.

23.23.19. SPAETH, J. N., and AFANASIEV, M. **The effect of sterilization with calcium hypochlorite on germination of certain seeds.** *J. For.* 37, 1939 (371–2). [Cornell Agric. Exp. Sta.]

It is shown that calcium hypochlorite is effective in retarding the germination and greatly reducing the germination percentage of certain forest tree seeds.

23.23.19 : 12.23.15 : 12.28.72. ROHMEDER, E. **The germination of *Sambucus racemosa*.** *Forstwiss. Cbl.* 61, 1939 (505–11). [G.g.]

The seeds and berries must either be sown immediately after collection in autumn or stored in moist sand in the open until spring. Dry winter storage at room temperature prevents after-ripening and reduces germination capacity. The sowing of clean seeds gave better results than the sowing of berries.

23.23.19 : 12.25.52–3. ZACHARIEW, B. J. **A convenient process of rapid germination for testing the seed of certain conifers** [concld.]. *Forstwiss. Cbl.* 61, 1939 (281–93). [G.]

The object of this method is to reduce the duration of germination tests, including soaking, to 6 days for Scots Pine and Austrian Pine and to 7 days for Spruce. The samples are soaked in water for 24 hours after which ⅛ to ¼ of each seed is cut off at the curved end containing the cotyledons with a sharp razor blade. The germination tests are carried out in Liebenberg's apparatus under ordinary conditions of room temperature of 18° to 25° C. with free admission of diffused daylight. The two criteria which are sufficiently reliable to allow of estimating the germinative ability are (1) length of protruding germ 1 mm. or more, and (2) discoloration of the germ. Results based on these criteria closely resemble those obtained from ordinary germination tests of 15 or more days' duration. In the case of Spruce better results are obtained for the first criterion when diffused light is only partly admitted during germination.

23.23.19 : 12.28.47(91.4). Denoga, N. **Germination of Teak.** *Philipp. J. For.* 2, 1939 (173–83).

Although the germination percentages (up to 60 per cent. and more) obtained in the tests were generally higher than those obtained in previous local attempts to germinate Teak seed, they were still lower than those reached by some workers in India. The best results for each group of tests were obtained with surface sowing, soil treatments with 1 part ash to 2 or 5 parts clay-loam, and seed storage for 20 to 60 days in shaded pits.

23.24. Formation of Crops by Planting

23.24 : 12.25.53 (54.2). Howard, S. H. **Chir in chandars.** *Indian For.* 65, 1939 (481–4).

An editor's note defines 'chandars' as 'grassy open areas in Sal forests often extending over hundreds of acres, maintained in that state through fire, frost, or water-logging, possibly of artificial origin and frequently covered with tall, coarse grasses'.

Results of present experiments indicate that 15-month Chir (*Pinus longifolia*) transplants may be used successfully in the United Provinces as a nurse species to Sal (*Shorea robusta*) in such areas as a protection against frost. Seeds are sown in May at the top of conical, bottomless clay pots, 3 in. top diameter, 5 in. bottom diameter, and 8 in. long. The plants are grown under shade and planted with the ball of earth containing them in July of the year following sowing, just as the rains break.

23.24 : 42.22 (77.4). Rudolf, P. O. **Why forest plantations fail.** *J. For.* 37, 1939 (377–83).

A study conducted on the Hudson National Forest in lower Michigan in the fall of 1936, after the severe drought of that year, disclosed that planted trees with roots predominantly in a single plane had significantly greater mortality and poorer height growth than those with better root distribution, that heat and drought accounted for most of the mortality, with heat playing a major role, and that neither soil acidity nor percentage of fine material showed any significant relationship to survival. Scots Pine has shown better resistance to drought and heat than either Red Pine or Jack Pine. *From author's summary.*

23.24.11 (73). Olson, D. S. **A forester's analysis of the commercial nurseryman's viewpoint.** *J. For.* 37, 1939 (471–3).

Particularly as related to various federal and state tree-planting programmes in the United States.

23.26. Plant rearing. Nursery Practice

23.26 : 12.11.2 : 21.4 : 12.25.53. Plank, D. K. **Root response of Slash Pine seedlings to indole-butyric acid.** *J. For.* 37, 1939 (497–8). [University of Florida.]

A preliminary investigation indicates that treatment with indole-butyric acid (10 parts per million optimum) is effective in accelerating the root growth of Slash Pine seedlings.

23.26.7 : 07.7. Brener, W. H. **Multiple use sprayer for the application of liquid fertilizers, insecticides, and soil disinfectants in forest nurseries.** *J. For.* 37, 1939 (630–1). [Wisconsin Conservation Dep.]

A 200-gallon wooden tank mounted on a 1½-ton truck chassis and equipped with a pressure pump and propeller-type agitator, both connected with the drive shaft of the car. Two horizontal spray pipes with $\frac{1}{16}$-in. nozzles are used for distributing the liquid at approximately 1 gallon per 100 ft. of 4-ft. seed-bed, four trips being made over each seed-bed per treatment.

23.26.7 : 12.12 : 47. Davis, W. C., Young, G. Y., Latham, D. H., and Hartley, C. **Diseases of Conifers in forest nurseries.** U.S.D.A., Divn. of Forest Pathology, Bureau of Plant Industry. 1938. pp. 63.

This paper deals with seed decay, damping-off and related problems, parasitic and non-parasitic diseases of older nursery stock, nursery losses resulting from mechanical and related causes, control measures, and general nursery practice that influences diseases. A key for distinguishing the more common causes of injury is included.

23.3. *Afforestation*

23.3 (45.8). Cappuccini, G. **Reforestation in Sicily.** *Riv. for. ital.* 1, 1939 (21–35). [It.]

A survey of the work in progress.

23.3 : 09·7 (481). Smitt, A. Vestlandet: tall, problemer og hypoteser [**Vestland : figures,**

problems, and hypotheses]. *Tidsskr. Skogbr.* 47, 1939 (107–15, 174–87). [Nor.]

The four Norwegian 'counties' known collectively as Vestland make up 18 per cent. of the total area and 25 per cent. of the population of the country. They form a single unit characterized by humid and relatively equable climatic conditions. Forest already covers 5 million dekares, and 10 million dekares of suitable land are estimated to be available for afforestation. The present forest area is divided almost equally into conifers and hardwoods, the chief trees being Scots Pine and Birch. On sites of good quality neither of these species makes the best use of the ground, and research is now directed towards finding suitable species to replace them. In view of the similarity of climate, conifers from the Pacific coast of America should thrive, and experimental plantings, though as yet too young for definite pronouncements, are said to show remarkable promise. Older plantations of Norway Spruce exist, and these have proved much superior in yield and vigour to Scots Pine. The author strongly recommends that Scots Pine and Birch should be retired to the low-quality sites and replaced on the better sites by Norway Spruce and other high-quality pulpwood producers.

23.35 : 11.42.3 : 11.48.2 (489). Bornebusch, C. H. Hededegeneration og regeneration af en for skov tjenlig humustilstand på de danske lyngheder. [**Heathland degeneration and the restoration on Danish Calluna heaths of humus conditions suitable for forest.**] *Svenska SkogsvFören. Tidskr.* 37, 1939 (316–26). [Da.]

Over large areas of Jutland the soil is a coarse-grained glacial sand, extremely poor in mineral nutrients and for the most part without any admixture of finer sand or clay. It is markedly podsolized and has formed a thick but rather soft pan at a depth of about 25 to 30 cm. Pollen analyses and finds of stumps suggest that Scots Pine was the original cover, but the present natural vegetation is heathland dominated by *Calluna vulgaris*, *Empetrum nigrum*, and *Cladonia* spp. The Pine forest appears to have given way to heathland during the Neolithic and Bronze Ages, probably as a result of heath fires and grazing. Such areas have been difficult to afforest. In early afforestation projects the heath was burnt, shallowly ploughed, and left for about 3 years, during which the ground was tilled at intervals. Planting was done after a final deep ploughing to break the pan. The crop aimed at was Norway Spruce, but to ensure success it was necessary to interplant *Pinus montana*. Spruce showed poor growth for some years after planting, but, as soon as the Pines established cover, normal growth was achieved. Once the Spruce had formed canopy it was able to build up and maintain humus conditions suitable for its own continued growth. Pure plantations of Spruce have been known to succeed, but only after prolonged and intensive cultivation of the soil: interplanting with *Pinus montana* is cheaper, quicker, and more certain. More recently a modification of the method has met with still greater success. A pure stand of *Pinus montana* is first raised by planting out 2-year-old seedlings in ploughed furrows where the pan has been broken. As soon as the Pines have closed canopy and a good needle litter has developed, light thinnings are made preparatory to planting. Until the new crop of Spruce is established, the Pines are removed slowly and carefully to guard against reversion to heath and to ensure shelter against night frosts. Clear felling of the Pine results in irregularity or failure of the succeeding Spruce. Underplanting is cheaper and more satisfactory than the older method, since the Spruce makes far better growth. Some success has also attended underplantings with Silver Fir, Douglas Fir, and Japanese Larch. Mor formation is checked in the older plantations by retaining the Pine as long as possible and by frequently thinning the Spruce. In the new underplantings efforts are made to secure a mixture of Pine, Larch, *Quercus borealis*, &c. *Quercus borealis* in particular is said to have a great capacity for forming mull in soils where most other trees produce mor. The author suggests that the 'biological' method of preventing reversion to heathland should receive more attention in Sweden and urges the need for research on suitable mixtures of species.

23.35 : 23.51–2 : 96 (489). Flensborg, C. E. Om Foryngelse af Fredskovplantager i Jylland. [**On the regeneration of protection-forest plantations in Jutland.**] *Dansk Skovforen. Tidsskr.* 1939 (313–41). [Da.]

Since 1870 the Danish Heath Reclamation Society (*Hedeselskab*) has been active in promoting the afforestation of heathland, and similar work has also been carried out by the State Forest Service (*Statskovvæsen*) and the Dune Reclamation Service (*Klitvæsen*). In 1866 about 635,000 ha. of waste land existed in Jutland;

now scarcely 200,000 ha. remain, of which about 150,000 ha. are suitable for afforestation or agriculture. Both agricultural reclamation and afforestation have been subsidized by the government since in this region agriculture is largely dependent upon the shelter afforded by the forest plantations. The principal trees used have been Norway Spruce and Mountain Pine; some Silver Fir has also proved useful, but other conifers and hardwoods have a more restricted utility and thrive only in special localities. Mountain Pine has been indispensable as a nurse crop for other species. Many of the plantations have now reached an age when regeneration is necessary, and special difficulties have arisen owing to their scattered occurrence, the great majority being small woods under private ownership. A further difficulty has been to engage the interest of owners in regeneration and general improvement work. The Heath Reclamation Society seems to have found a promising solution of this problem by creating a 'Flying Squad' (*Det Flyvende Korps*) of unemployed farm workers trained as woodmen and directed by about 10 forest rangers. The timber cut is disposed of by the Society, which pays the net profit to the owner or agrees with him to use the money for underplanting or other improvements. A joint subsidy from the Ministry of Agriculture and the Society for the purchase of plants has induced owners to prepare the ground and to allow the Flying Squad to assist in cutting and planting operations. Stands of Mountain Pine are best regenerated by underplanting accompanied by a uniform, gradual opening of the canopy, the litter being left as an important check to the growth of grass and weeds. The succeeding crop is generally Spruce, though other trees may do well in special localities. Thinnings amply repay cultural and planting operations. The regeneration of Spruce and Silver Fir offers greater difficulties, since Spruce is often badly attacked by *Polyporus annosus* and both species are liable to stormthrow. Storm-thrown areas are often infested with weevils, and in such cases they are left for 1–3 years before replanting; grass and weeds are also troublesome and a nurse crop of Birch and Grey Alder is then advisable. Where stands of Spruce have been severely damaged by *Polyporus annosus*, Silver Fir is recommended as the succeeding crop; but if the old Spruce is healthy, Spruce may again be planted. Natural regeneration is regarded by the author as unprofitable except for purely protective plantations of Mountain Pine on dunes or in places where the soil is too poor for more exacting and more valuable species.

23.38 (42). James, N. D. G. **The planting of tips and slag heaps.** *Quart. J. For.* 33, 1939 (164–72).

Different types of waste material deposits such as colliery waste, quarry waste, and soil waste are classified and particular consideration is given to soil conditions in each case. A list of tree species is included to be used as a guide in planting various classes of tips.

23.38 (91). Bunting, B. **Planting of roadside trees in Malaya.** *Malay. agric. J.* 27, 1939 (249–65). P.R.

Notes on shade trees, avenue trees, and ornamental palms suitable for roadside planting and on methods of planting and the maintenance of trees and palms.

23.38 : 21.5 (57.6). Gursky, A. V. **Unirrigated tree propagation in deserts.** *Proceedings of the Lenin Academy of Agricultural Sciences of U.S.S.R.* Nos. 2–3. 1939 (35–40) [R. r.] A.P.B.

Report on 8 years of experimental work mainly on several *Amygdalus* species and on *Pistacia vera* L. at a station in south-western Turkman, Russian Turkestan (320 m. above sea-level; annual precipitation 200–420 mm.; annual average temperature 15°; average July temperature 29°; grey desert soil). It was possible to produce trees 2–2·8 m. high. Almond fruiting amounted to 5–8 per cent. of the normal yield of comparable trees under irrigation. Methods recommended for unirrigated tree cultivation under desert conditions include (1) artificial reduction of crown volume by pruning, (2) use of shrubby, deeply rooted wildings in the case of almonds, (3) planting of not more than 80–100 trees per hectare. With such spacing, root competition in almonds and pistachios is delayed until the trees are 3–5 years old, and (4) weeding and harrowing of the soil to eliminate herb vegetation.

24. EDUCATION OF STANDS. TENDING. THINNING

24 : 23.5 (76.2). Hall, W. L. **Building up a Shortleaf-Loblolly forest in Arkansas.** *J. For.* 37, 1939 (538–40).

Localized and intensive silvicultural operations in second-growth stands of Shortleaf and

Loblolly Pine that should greatly improve the production of the land and increase the value of the stand.

24 : 23.7 : 12.25.3(79). Fritz, E. **How much forestry is needed in the Redwoods for continuous production?** *J. For.* 37, 1939 (618–19).

Economic selective logging, saving as many residual trees as is practical and preventing damage to good immature trees, with careful burning of slash and protection of cut-over lands for the production of future crops.

24.1. *Cleanings*

24.1–2 : 24.5 (485). Bundy, O. Några synpunkter på lövträds behandling i mellansvenskt skogsbruk. [**Some points of view on the treatment of hardwoods in central Swedish forestry.**] *Skogsägaren* 15, 1939(187–90). [Sw.]

If the raising of hardwoods is to be profitable the trees must be of large diameter but fast grown and free from decay or branches. The best method of securing such trees is by live pruning and the provision of ample crown space. It is recommended that the most promising saplings should be chosen in the thicket stage, freed from the surrounding thicket, and pruned if necessary. A further cleaning and pruning should follow in 4–5 years' time, after which ordinary thinnings should be made at intervals.

24.2. *Thinnings*

24.2 : 24.5 : 5 : 66 : 12.25.3–5 [68]. Craib, I. J. **Thinning, pruning, and management studies on the main exotic conifers grown in South Africa.** *Sci. Bull. Dep. Agric. For. S. Afr.* No. 196. 1939. pp. 179. Govt. Printer, Pretoria.

The object of these studies is to find a suitable standard of silvicultural technique for the plantations of exotic conifers in South Africa, and also to determine the intermediate yields from such plantations. Data on mean diameter and height, obtained from the measurement of a large number of sample trees of all ages, sizes, and site classes, are correlated with age and site quality. Thinning schedules are prepared on a composite basis of height, diameter, and age for the three most important exotic conifers *Pinus insignis* (*P. radiata*), *P. pinaster*, and *P. patula*. These schedules follow contemporary thinning practice and embody certain recognized principles such as close initial spacing, maintenance of canopy, and that, for a given age, poor site qualities should carry more trees than favourable sites. Standard volume tables and percentage utilization tables for the three species are included. Rotations are suggested and data are given to show the effect of thinning on increment. Intermediate yields may be determined for any compartment by applying information on age, diameter, and density to the data presented in the standard tables.

Pruning for the production of knot-free timber, when associated with the diameter increment produced under contemporary thinning practice, must be limited by economic considerations, and furthermore must be confined to the removal of living branches. The minimum economic radius of clear lumber to be grown after pruning is determined to be 4 in. Data on taper and bark thickness are given for trees of all sizes for the three species and the correlation of permissible pruning with diameter increment is shown. In the pruning schedules presented for the three species it is established that for the fast-growing species *Pinus insignis* on site 1 pruning should be carried to a maximum height of 22 ft. and on site 2 to a maximum height of 10 ft., while no pruning is permitted on site 3. Owing to low anticipated diameter at maturity the only pruning allowed for *P. pinaster* is on site 1 up to a height of 7 ft. The schedule for *P. patula* is similar to that for *P. insignis*. The removal of branches up to half the total living crown length has little effect on height and diameter increment, though the removal of more than this proportion has a marked adverse effect.

Expected volume production under contemporary thinning practice, as regards both intermediate and final yield, is presented for the three species growing on three site qualities. From an analysis of these data it is determined that a high percentage of the conifers are of slow-growing species, that only a small part of the afforested area is of first quality, and that only a small portion of the plantations are likely to pay their costs. Under contemporary thinning practice a high percentage of the logs that are produced are small—of low volume and low value—and the cost of production is high. It is also determined that the stems produced on the poorer sites are not only slow growing but are of relatively low value for their size.

A critical examination of the yield tables for the three species indicates that, with present methods, satisfactory results will be obtained

only from fast- and medium-fast-growing species on the best quality sites. An investigation of a thinning experiment of nine sample plots indicates that diameter increment is strongly influenced by degree of thinning and that the response of suppressed trees is particularly high when the stand is thinned beyond recognized silvicultural limits. It is also shown that intensive, costly methods of plantation establishment are not justified. Local investigations indicate that wood density is not affected by rate of growth. Based on these considerations new management schedules are suggested which include (1) wide initial spacing, particularly for poor sites and slow-growing species, (2) pitting or spot preparation rather than ploughing or broadcast picking by hand, (3) maintenance of indigenous, scrubby, and herbaceous vegetation on certain planted areas to improve soil conditions, (4) gradual pruning of living branches up to a height of 22 ft. on the crop trees of all stands, and (5) thinning schedules to vary with species and site with the object of maintaining in all stands the increment rate of the fast-growing species on favourable sites, growing under contemporary thinning practice, and of producing at maturity a mean diameter of approximately 18 in. for all species and sites. A principle that is basic to these schedules is that sites of poor quality should bear fewer trees than favourable sites. Detailed data are given to show the anticipated results of the proposed changes in silvicultural policy.

Recommendations are made regarding the treatment of the present existing coniferous stands under the new management schedule, after first revising the height-age data for various species of Pine as a basis for the accurate assessment of site quality. Data are given on the volume of wood that is and will be available for utilization, and the milling facilities required for dealing with this wood are outlined. Management schedules are drawn up for the treatment of stands of various ages, including proposed plantations that are not as yet established.

24.2 : 12.25.53 (71.1). EISLER, H. P. **Thinning operations in Lodgepole Pine.** *For. Chron.* 15, 1939 (85–7). [Saskatchewan Forest Service, Regina.]

Second-growth polewood stands in the Cypress Hills, Saskatchewan. Operations have been carried on regularly since 1924 to supply the local demand for small-diametered material, supplemented by non-commercial silvicultural operations for the purpose of reducing fire hazard and removing dead and inferior competitive stems, particularly in very dense stands. The natural stocking of these stands, approximately 55 years old, varies from 1,600 to 3,500 stems per acre.

24.21 : 12.25.53. REYNOLDS, R. R. **Improvement cuttings in Shortleaf and Loblolly Pine.** *J. For.* 37, 1939 (568–70). [Southern For. Exp. Sta., New Orleans.]

The cutting of financially mature trees, both Pine and hardwoods, for purposes of stand improvement, can be done at a profit in parts of the southern states. Certain types and species of trees are noted as being unprofitable to cut at the present time.

24.22 : 24.25.1. MOLDENHAWER, K. Gallringsintervallernas längd. [**The length of the thinning cycle.**] *Skogen* 26, 1939 (267–70). [Sw.]

It is claimed that the light, short-interval thinnings favoured in parts of southern Sweden give a higher yield and a more constant increment per cent. than heavy thinning with a longer cycle. At the close of a long cycle the tree crowns are usually overcrowded and often deformed, while the chlorophyll layer of the young bark, which has been shown by P. Larsen to exert a considerable influence upon increment, is ineffective owing to deficiency of light. Such stands are normally subjected to a heavy thinning, $\frac{1}{4}$ to $\frac{1}{3}$ of the timber being removed since 10 to 15 or even 20 years may elapse before the next thinning. The narrow, misshapen crowns respond to thinning mainly by height growth and are slow to develop. By the middle of the cycle the worst of the damage is repaired, but overcrowding again sets in and undoes the good effects of freeing. Timber production under such conditions can approach a satisfactory level only during the middle of the cycle. The author concludes that light thinnings should be made as often as they will pay their way.

24.23 : 31.42.1 : 12.25.6. BARRETT, J. **Timber salvage from Douglas Fir trees infected with conk rot [*Trametes pini*].** *J. For.* 37, 1939 (577–8).

This study, undertaken in the north-western United States, indicates that in general Douglas Fir heavily infected with *Trametes pini* should be left standing, whereas lightly infected trees and all doubtful ones should be felled.

24.3. *Opening of the Canopy and Release Cuttings*

24.33 : 12.25.53 (76). Bull, H. **Increased growth of Loblolly Pine as a result of cutting and girdling large hardwoods.** *J. For.* 37, 1939 (642–5). [Southern Forest Exp. Sta.]

Loblolly Pine of pulpwood size within 15 ft. of hardwoods that had been removed or girdled showed a basal area increase of 75·4 per cent. in 5 years after release, whereas similar-sized Pine within the same distance of untreated hardwoods showed an increase of only 21·6 per cent. Pulpwood volume increased 82 per cent. in 5 years on the improved plot and only 33 per cent. on the check plot.

24.4. *Shelterbelts. Severance cuttings. Windbreaks*

24.4 (71.1). Edwards, C. A. **Field crop shelterbelts in Western Canada.** *For. Chron.* 15, 1939 (99–102). [Forest Nursery Station, Indian Head, Saskatchewan.]

Observations on the protective value of shelterbelts for agriculture in Saskatchewan.

24.41 (45.7). Savi, L. I frangivento della Bonifica di Mussolinia. **[The windbreaks of the Bonifica di Mussolinia.]** *Riv. for. ital.* 1, 1939 (23–37). [It.]

In the Bonifica di Mussolinia, near Oristano, Sardinia, the fields are protected from frequent and strong north-west winds by means of shelterbelts 30 to 40 m. wide. The main species planted in these shelterbelts are Eucalypts, including *E. rostrata*, for which detailed growth data are given.

24.5. *Tending of Trees. Pruning*

24.5 : 07.7. Geddes, J. G., and Erickson, A. G. **The use of the two-hand pruning shear in forest pruning.** *J. For.* 37, 1939 (519–21).

Increased leverage and the use of two sharp cutting blades, so placed that they make a close, clean cut, has improved the pruning shear as regards efficiency and speed of use, and in consequence fatigue from operating this tool has been reduced. Reference is made to other pruning tools, including a double-edged impact cutter on a pole which is of new design and is of particular use in removing higher branches.

24.5 : 12.12 : 12.25.52. Paterson, A. **The occlusion of pruning wounds in Norway Spruce [*Picea excelsa*].** *Ann. Bot., Lond.*, [*n.s.*] 2, 1938 (681–98). O.B.D.

The tissues of stem and branch of Norway Spruce are continuous in the bud stage only; as development proceeds the cambial cells of the crotch region become reoriented, so that the branch tissues all turn downwards and continuity of wood exists along the lower side of the branch only. Die-back in both live- and dead-pruned branches is worst on the lower side of the branch, but in live-pruned branches the length of die-back is relatively short. On the whole, live-pruning seems preferable to dead-pruning, since occlusion is more rapid and distortion of the wood less. No evidence was found that live-pruned branches are more liable to decay. Dead-pruning can result in black loose knots in the timber as a consequence of the inflow of wound gum from the occluding tissue into the stub of the branch. An examination of a number of broken pitprops showed that failure had always occurred at a whorl of knots, since in such places the area of vertically continuous wood is reduced and the pressure per unit area increased. Live-pruning should also help to obviate this defect by securing the formation of a continuous vertical cylinder of wood.

24.5 : 12.25.53. Buchholz, E. **A new method of raising Pine timber without knots.** *Forstarchiv* 15, 1939 (246–7). [G.]

A note on Krotkevitch's experiments at the Kiev Forestry Research Institute. By removing all the lateral buds of the main shoots each spring Krotkevitch succeeded in raising young Pine trees that were entirely straight and free from knots. The operation was begun on 8-year-old plants about 1·5 m. high, which had already formed 4–5 whorls of branches, and was continued until the trees reached a height of 6–7 m. when their crowns were allowed to develop freely. The removal of the lateral buds did not influence height growth but did result in an 18 to 25 per cent. increase in diameter growth and in a greatly stimulated development of needles on the main shoots. With a stocking density of 700 trees per ha. 60 to 80 working hours were required to develop clean boles 6 m. long. The work was done by women and youths with the aid of specially constructed simple instruments and portable ladders. Krotkevitch claims the following advantages for his

method: (1) Possibility of growing ideal timber for the aeroplane and plywood industries on a rotation of 30 to 40 years. (2) Higher volume production than in the case of ordinary pruning. (3) No risk of infection by fungi, &c., since the small wounds are covered almost immediately with a drop of resin and heal very quickly. (4) The method is simpler than ordinary pruning.

24.7. *Slash Disposal and Clearing of Site*

23.7 : 23.13 (77). CHENEY, E. G. **Slash again in the Lake States.** *J. For.* 37, 1939 (640–1).

The excessive cost of piling and burning slash. The value of this operation is questioned both as regards a fire-preventive measure and as an aid to reproduction.

3. UTILIZATION. TECHNOLOGY

3 : 01.6. **List of publications on logging, manufacture, and utilization of timber, lumber and other wooden products.** U.S.D.A., Forest Service, Forest Products Laboratory, Madison, Wisconsin. 1939. pp. 31.

3 : 09.4 : 09.7 (72). FLEMING, G. ROBERTSON. **Timbers and trade of Mexico.** *Wood* 4, 1939 (341–5).

Including a tabulated list of the timbers, their sizes, description, uses and special features.

31. PROPERTIES OF WOOD. TIMBER RESEARCH

31 : 12.25.53. **Scots Pine.** *Holz* 2, 1939 (317–18). [G.]

Table of characters and properties of *Pinus sylvestris* L., compiled at Eberswalde.

31 : 12.26.21. **Common Alder.** *Holz* 2, 1939 (215–16). [G.]

Table of characters and properties of *Alnus glutinosa* Gaertn., compiled at Eberswalde.

31 : 12.26.51. **Iroko, *Chlorophora excelsa* Benth. et Hook.** [*Moraceae*]. *Merkblätter über Koloniale Nutzhölzer* No. 3. Inst. f. ausländ. und Kol. Forstw., Tharandt. 1939. pp. 9. [G.] P.R.

31 : 12.27.13. **Ilomba, *Pycnanthus kombo* [H. Baill.] Warb.-Holl.** [*Myristicaceae*]. *Merkblätter über Koloniale Nutzhölzer* No. 5. Inst. f. ausländ. und Kol. Forstw., Tharandt. 1939. pp. 9. [G.] P.R.

31 : 12.27.56. **Limba, *Terminalia superba* Engl. et Diels** [*Combretaceae*]. *Merkblätter über Koloniale Nutzhölzer* No. 2. 1939. Inst. f. ausländ. und Kol. Forstw., Tharandt. 1939. pp. 9. [G.] P.R.

31 : 12.27.62. **Westafrikanische Ceiba, *Ceiba pentandra* [L.] Gaertn.** [*Bombacaceae*]. *Merkblätter über Koloniale Nutzhölzer* No. 6. Inst. f. ausländ. und Kol. Forstw., Tharandt. 1939. pp. 10. [G.] P.R.

31 : 12.27.64. **Abachi, *Triplochiton scleroxylon* K. Schum.** [*Sterculiaceae*]. *Merkblätter über Koloniale Nutzhölzer* No. 1. Inst. f. ausländ. und Kol. Forstw., Tharandt. 1939. pp. 8. [G.] P.R.

31 : 12.27.72. **N'Gollon, *Khaya ivorensis* A. Chev.** [*Meliaceae*]. *Merkblätter über Koloniale Nutzhölzer* No. 7. Inst. f. ausländ. und Kol. Forstw., Tharandt. 1939. pp. 8. [G.] P.R.

31 : 12.28.47. **Teak.** *Holz* 2, 1939 (319–20). [G.]

Table of characters and properties of *Tectona grandis* L.f., compiled at Eberswalde.

31 : 12.28.71. **Bilinga, *Sarcocephalus trillesii* Pierre** [*Rubiaceae*]. *Merkblätter über Koloniale Nutzhölzer* No. 4. Inst. f. ausländ. und Kol. Forstw., Tharandt. 1939. pp. 8. [G.] P.R.

31 : 33 : 01.6. **List of publications on mechanical properties and structural uses of wood and wood products.** U.S.D.A., Forest Service, Forest Products Laboratory, Madison, Wisconsin. 1938. pp. 27.

31 : 33.15. WEBER, C. G., and WEISSBERG, S. G. **Properties of some fiber building boards of current manufacture.** *Rep. U.S. Bur. Stand.* BMS 13. Washington. 1939. pp. 5. P.R.

The average heat-transmission value was 0·35 for the ½-in. insulating boards, and 0·38 for the ½-in. interior-finish insulating boards, the average densities being 17·1 and 20·5 lb., respectively. These data indicate that the surface treatment of the wall-finish boards raises the density slightly and that the insulating value

is decreased accordingly. The boards show a wide range of values for permeability to air and water. A thermal conductivity of 0·33 to 0·36 is the minimum that was obtained in ½-in. boards that met the strength requirements contained in the Federal specification for fibre insulating board. The strength properties show a considerable range of values for bending strength and nail-holding strength. The insulation sheathing boards had high strength because of their greater thickness, and the low permeability to water and air was significant. That the source of the vegetable fibre used had a relatively unimportant effect on the essential properties of the boards may be observed from the rather uniformly good correlation between the density and other properties, especially thermal conductivity, for all boards. *From Author's summary.*

31 : 33.36 : 12.19.2 : 12.25.5. KALNIŅŠ, A., and LIEPIŅŠ, R. **Technical properties of Latvian coniferous timber [*Pinus silvestris* L., *Picea excelsa* Lk., and *Larix europaea* D.C.] with relation to conditions of growth.** *Rep. latv. For. Res. Sta.* No. 10. 1938. pp. 87. [E. latv.].

Data on the physical and chemical properties of the timbers in relation to their respective forest types, with notes on seasoning and preservation.

31 : 12.26.85 : 12.27.38 (66.9). JENTSCH, F., APPEL, E., and SCHMIDT, E. **Descriptions of tropical woods from the primeval forest of the Cameroons.** *Kolonialforstl. Mitt.* 1, 1939 (425–32). [G.]

The species dealt with are *Coula edulis* Baill., *Strombosia glaucescens* Engl., *Strombosiopsis tetranda* Engl., and *Mammea ebboro* Pierre.

31 : 12.27.62 (73). RECORD, S. J. **American woods of the family *Bombacaceae*.** *Trop. Woods* 59, 1939 (1–20).

31 : 12.28.35 (73). RECORD, S. J. **American woods of the family *Sapotaceae*.** *Trop. Woods* 59, 1939 (21–51).

31 : 12.27.88 (73). RECORD, S. J. **American woods of the family *Rhamnaceae*.** *Trop. Woods* 58, 1939 (6–24).

Description of the woods of 13 genera found in U.S.A.

31 : 12.2 (866). ACOSTA SOLIS, M. Productos forestales del Ecuador. Principales maderas del Ecuador. **[Forest products of Ecuador. Principal timber species of Ecuador.]** *Maderil, B. Aires.* 12, 1939 (7–10, 27–8). [Span. span.]

Ecuador is rich in tropical forest products, and there is a great variety of tree species deserving the attention of foreign extraction firms. It is the Government's duty to make a scientific survey of the country's forest resources with a view to their proper utilization and development. The paper includes the annotated lists of species of (1) valuable timber species known on the international market, including *Swietenia*, *Cedrela*, and *Ebenus* spp.; (2) valuable species not known on the international market; (3) timbers utilized in Ecuador only; (4) species introduced to the 'Sierra', the dryland of Ecuador, which include *Eucalyptus globulus*, *Cupressus pyramidalis*, *Tamarindus occidentalis*, and a *Populus* species called Alamo —all of which have been successfully acclimatized; and (5) species which may prove useful for home consumption and export, the properties of which have not as yet been ascertained.

31 : 12.27.39 (91). THOMAS, A. V. **The timber of *Shorea gibbosa* Brandis.** *Malay. Forester* 8, 1939 (127–9).

The timber of *Shorea gibbosa* belongs to the White Meranti sub-group 2. It is very easy to saw, not durable, and probably difficult to impregnate with preservatives. It appears to be as strong, if not stronger, than the typical light red Merantis. It should be suitable, if protected from termites, for light building construction, flooring, joinery, interior fittings, and decking, and might make satisfactory plywood. Locally it is used for planking and cheap Chinese coffins. *Author's summary.*

31 (97). BOULTON, E. H. B. **Notes on some Empire timbers.** *Wood* 4, 1939 (353–5).

31.1. *Structure*

31.13–14. KRAMER, P. R. **The woods of *Billia*, *Cashalia*, *Henoonia*, and *Juliania*.** *Trop. Woods* 58, 1939 (1–5).

On a basis of the wood anatomy, *Billia* is readily distinguished from *Aesculus*; the two species of *Cashalia* are very similar; *Henoonia* belongs with the Sapotaceae and resembles *Bumelia*; the Julianiaceae are very closely related to the Anacardiaceae. *Author's summary.*

31.13 : 12.14.1 : 12.11. PRESTON, R. D. **Wall structure and growth: I. Spring vessels in**

some ring-porous dicotyledons. *Ann. Bot., Lond.* [*n.s.*] 3, 1939 (507–30). [Botany Department, University of Leeds.] O.B.D.

In the bulk of the vessel elements of some ring-porous dicotyledonous trees, as examined under the polarizing microscope, the walls were composed of cellulose chains lying in one direction only and forming a rather flat spiral, the inclination of which varied within one and the same element. The flattening of the spiral from a steeper spiral in the cambial initial is thought to occur during a period of mechanical extension following an early phase in which extension takes place by active growth of the wall itself. All the species examined had a few isolated vessels whose elements showed more complex wall structure; in these cases at least three layers were visible in cross-section, and the direction of the micelles changed from layer to layer. Technique and the possible significance of the results on conceptions of vessel development are discussed.

31.13 : 12.14.2 : 12.26.75. JOSHI, A. C. **Some salient points in the evolution of the secondary vascular cylinder of Amarantaceae and Chenopodiaceae.** *Amer. J. Bot.*, 24, 1937 (3–9).

A comparative study of anomalous secondary thickening in the stem and root of species of *Alternanthera*, *Achyranthes*, *Pupalia*, *Amarantus*, *Atriplex*, *Chenopodium*, and *Suaeda*. Anomalous secondary thickening may be present in the root or the base of the stem when it is absent from the larger part of the stem. The presence of secondary thickening by a succession of secondary cambiums, e.g. some species of *Amarantus*, is an ancestral character in these families and the renewal of secondary cambiums in complete rings or large areas is a primitive character. *From author's summary.*

31.13 : 12.14.2 : 12.27.52. JOSHI, A. C. **Secondary thickening in stem of *Stellera chamaejasmae* Linn.** *Proc. Ind. Acad. Sci.* 2 : 5 : 424–36, 1935.

Secondary thickening of the stem is characterized by a series of zones of wood and bast separated by tangential bands of parenchyma; towards the periphery this leads to the formation of interxylary (included) phloem. This invalidates the suggestion that the two tribes Aquilarioideae and Thymelaeoideae of the family Thymelaeaceae can be distinguished by the occurrence of this feature.

31.13 : 12.2. DADSWELL, H. E. **The role of wood anatomy in forest botany.** *J. Coun. sci. industr. Res. Aust.* 12, 1939 (137–43). P.R.

The wood anatomist can be of definite assistance to the botanist (*a*) in the classification of certain genera where botanical confusion exists, (*b*) in the study of the internal arrangement of families, and (*c*) in the determination of the probable affinities of doubtful families. *From author's summary.*

31.13 : 12.26.22 (73). WILLIAMS, S. **Secondary vascular tissues of the Oaks indigenous to the United States. I. The importance of secondary xylem in delimiting Erythrobalanus and Leucobalanus.** *Bull. Torrey bot. Cl.* 66 (353–65). O.B.D.

Systematists do not agree about the grouping of the species of *Quercus* into subgenera, and the criteria used to define *Leucobalanus* (the White Oaks) and *Erythrobalanus* (the Red Oaks) do not provide for a satisfactory segregation of species according to their natural affinities. The American species can be separated into two distinct groups by means of the anatomy of the latewood. These groups correspond with those of the systematists except that the Red Oak group includes eight species that are placed by systematists in *Leucobalanus*. (*Q. emoryi* Torr., *Q. dumosa* Nutt., *Q. virginiana* Mill., *Q. reticulata* H.B.K., *Q. arizonica* Sarg., *Q. oblongifolia* Torr., *Q. engelmanni* Greene, and *Q. douglasii* Hook. and Arn.). The margins of the leaves of all these exceptions are devoid of the bristle-tipped lobes or spiny teeth that are characteristic of all the remaining members of *Leucobalanus*. It is therefore proposed that these two subgenera should be defined as follows: *Leucobalanus*: latewood pores angled, thin-walled; leaves devoid of spinose teeth or bristle-tipped lobes. *Erythrobalanus*: summerwood pores rounded, thick-walled; leaves wholly or in part with bristle-tipped lobes, apex apiculate, or margins with spiny teeth. Although the evergreen oaks possess some tendencies to differ in anatomy, these differences are not considered consistent enough to justify the creation of a third subgenus.

31.13 : 31.2 : 12.27.82. VANIN, S. I. **The anatomic structure and physico-mechanical properties of the wood of *Euonymus verrucosa*.** *Sbornik Trudov Beresklet* 1938 (155–66). [R.e.] [The U.S.S.R. Central Forestry Research Institute, Leningrad.]

31.13 : 12.27.93. MAJUMDER, G. P. **On the occurrence of multiperforate plates in the xylem vessels of *Heracleum sphondylium* L.** *Repr.* from *Proc. Leeds. phil. Soc.*, Scientific Sec., 3, Part 10 (559–64).

The occurrence and position of multiperforate plates in the xylem vessels of leaves and stems of *Heracleum sphondylium* L. are described. They are found to be a regular feature in the protoxylem of leaves and in the metaxylem of nodal regions of stems. As exactly similar types of construction have been found in the plates associated with both the primitive and advanced types of xylem elements without any reference to the plane of perforation, no phylogenetic value is attached to them. The pattern of perforations appears to be determined by the occasional sporadic tendency of the vessel protoplast to form cellulose lamellae at its surface. *From author's summary.*

31.13 : 31.2 PRÜTZ, G. **On the relationhips between the microscopical structure and the physical and mechanical properties of woods.** *Kolonialforstl. Mitt.* 1, 1939 (347–90). [G.g.]

The species, which were mostly tropical, were arranged in four groups according to whether their woods had (*a*) abundant parenchyma, (*b*) very little parenchyma, (*c*) storied structure, or (*d*) normal structure. Compression and bending strengths were not significantly correlated with structure, but hardness, according to Brinell's method of testing, was usually greater in timbers with a high proportion of parenchyma. The paper includes microphotographs and a description of the 'damaged tissues' ('Schadstellen'). The detailed mechanism of damage through compression, &c., beyond the limit of resistance, is discussed.

31.13 : 31.27. CLARKE, S. H. **Recent work on the growth, structure, and properties of wood.** *Spec. Rep. For. Prod. Res., Lond.* No. 5. H.M. Stationery Office, London. 1939. pp. 32.

It is shown that the physico-chemical nature of cell walls is of greater importance than anatomical structure in determining certain types of strength and other properties. In particular the degree of lignification of the secondary walls of the fibres, as judged by the phloroglucin reaction, enables the compressive strength of individual specimens to be estimated with greater accuracy than is possible where only specific gravity and gross anatomical structure are taken into account. Some environmental factors influencing lignification are indicated.

Toughness, as measured by the work done in breaking a specimen transversely by a single blow, depends rather on the proportion and arrangement of the thin-walled elements, and on the properties of the middle lamellae and primary walls of the fibres; the secondary walls of the fibres are ordinarily so strong that they do not break when wood fails across the grain.

For practical purposes specific gravity is a useful index of timber strength, particularly in indicating a lower limit below which wood will inevitably be weak compared with the average for the species concerned. Ring width and the proportion of summerwood in ring-porous woods give visual indications of strength as related to specific gravity.

Comparison of Beech tension wood and normal wood of similar specific gravity indicates that so far as compressive strength and toughness are concerned tension wood compares more favourably with normal wood in the air-dry than in the green condition.

It is also shown that cell-wall composition influences the shrinkage and the machining properties of wood. *From author's summary.*

31.13 : 12.2 (54). CHOWDHURY, K. A. **The formation of growth rings in Indian trees Part I** (*a*) Chir [*Pinus longifolia*], (*b*) Cutch [*Acacia catechu*], (*c*) Jaman [*Eugenia jambolana*], (*d*) Laurel [*Terminalia tomentosa*], (*e*) Sal [*Shorea robusta*], (*f*) Semul [*Bombax malabaricum*], (*g*) Teak [*Tectona grandis*]. *Indian For. Rec.* [*n.s.*] Utilization 2, 1939. pp. 39.

Growth rings are distinct and annual in Chir, Teak, and Laurel, but only fairly distinct in Cutch and Semul. The irregular marks found in Jaman and Sal are not annual and could not be correlated with any external factor. Deciduous trees do not always show growth rings, nor are all evergreens without them.

Foliar development always preceded diameter growth in the main trunk, but the flushing of new leaves does not always indicate growth in the trunk, as the renewal of cambial activity may take two or three months to reach the base of the tree. In Chir and Teak activity spreads rapidly downwards and cambial activity has been observed simultaneously in twigs and trunk.

The effect of external factors such as temperature, rainfall, and humidity is discussed, but no direct correlations were found with either the beginning or the end of growth.

31.14. PLITT, T. M. **Microscopic methods used in identifying commercial fibers.** *Circ. U.S. Bur. Stand.* C 423. U.S. Government Printing Office, Washington. 1939. pp. 26. P.R.

31.14 : 3 : 12.27.49. NORMAND, D. **Identification and uses of *Afzelia* wood.** *Rev. Bot. appl.* 19, 215, 1939 (488–94). [F.f.] P.R.

31.2. *Physical Properties*

31.2. JAMES, N. D. G. **'Shake' in timber.** *J. Land Agents Soc.* 38, 1939 (480–3).

Shake is classified on the basis of location and size of cracks as heart shake, star shake, ring shake, and cup shake. Unfavourable soil conditions, frost, and wind damage are thought to be the more important causes of this condition. Spanish Chestnut (*Castanea sativa*) is highly susceptible to shake and the species Elm, Willows, Poplar, Horse Chestnut, Beech, and Lime also produce shaken timber. One precaution against this condition is not to plant species on sites unsuited for them.

31.2 : 12.25.53. PETTIFOR, C. B. **Baltic Redwood [*Pinus sylvestris* L.].** *Wood* 4, 1939 (295–6).

A brief discussion of the strength, density, and moisture content of small clear pieces of *Pinus sylvestris*. The relationships between these factors is illustrated graphically.

31.2 : 12.27.69. BRUSH, W. D. **Foreign woods: Lignumvitae [*Guajacum* species].** U.S.D.A., Forest Service, Washington, D.C. 1938. pp. 13.

The wood properties, principal uses, geographic distribution and soil requirements of the two most important species *Guajacum officinale* and *G. sanctum*. The general distribution is the West Indies, the coast of tropical North America, and the coast of northern South America. The source of the main supplies of good quality wood is the Dominican Republic and Haiti, and to a less extent Cuba, Nicaragua, and the west coast of Guatemala. The annual production varies from about 3,000 to 10,000 long tons (2,240 lb.). Species that have been substituted for the true Lignumvitae are listed and described briefly.

31.2 : 12.27.72. BRUSH, W. D. **Foreign woods: Mahogany [*Swietenia* species].** U.S.D.A., Forest Service, Washington, D.C. 1939. pp. 22.

The wood properties, principal uses, and geographical distribution of the genus *Swietenia* and in particular the species *S. mahagoni*, *S. humilis*, and *S. macrophylla*. These species require a rich, moist soil and warm climate, and grow mainly in the West Indies, Mexico, Central America, and northern South America. The present supply of this wood is difficult to estimate. The annual production is approximately 25,000,000 board feet. Other tree species that are called 'Mahogany' in trade are listed and described briefly.

31.2 : 12.28.47. BRUSH, W. D. **Foreign woods: Teak [*Tectona grandis*].** U.S.D.A., Forest Service, Washington, D.C. 1937. pp. 11.

The wood properties, principal uses, geographic distribution, and site requirements of *Tectona grandis*. Commercial quantities in the natural forest are found only in India, Siam, and Java. The estimated future annual production is about 600,000 tons. Available stands are being managed on a sustained yield basis. Tree species that are used as substitutes for Teak are listed and described briefly.

31.2 : 12.25.4 (71.1). PERRY, R. S. **Yellow Cedar [*Chamaecyparis nootkatensis* [Lamb.] Spach]: its characteristics, properties and uses.** *B.C. Lumberm.* 23, 1939 (30–1).

The natural range of this species is the Pacific Coast of North America from Southern Alaska to Northern Oregon. The total estimated stand is about 6 billion ft., half of which is found on the western side of the coast mountains in British Columbia. It usually grows in mixtures with Sitka Spruce, Western Hemlock, Fir, or Western Red Cedar. It averages 85 ft. in height and 3 ft. in diameter. It is a slow-growing species and is susceptible to heart rot, which makes it difficult to obtain large amounts of high-grade lumber. The wood is clear, yellow in colour, straight-grained, light in weight, of average strength and toughness, has a low shrinkage factor and is of high durability. Many of its uses are listed. The strength properties of this and other western commercial species are tabulated.

31.2 : 12.26.41 (71). **Canadian Aspen.** *Wood Information Series*, No. 48. Timber Com-

mission for Eastern Canada, 2 Cockspur Street, London, S.W.1. 1939. p. 1.

The properties of the wood are summarized. It has particular value as a speciality wood, being used for such products as wood wool.

31.2 : 12.27.39 (91.4). AGUILAR, L. **The mechanical properties of Apitong [*Dipterocarpus* spp.] from Tayabas Province and Negros and Basilan Islands.** *Philipp. J. For.* 2, 1939 (145–57).

31.21 : 31.8. SCHEFFER, T. C. **Mineral stain in Hard Maples and other hardwoods.** *J. For.* 37, 1939 (578–9).

Tests indicate that the so-called mineral stained wood has a higher carbonate content, a greater ash content, and to be somwehat harder than normal light wood. The cause of this condition has not yet been determined.

31.21.3 : 31.71 : 12.26.22. PRYOR, A. R. **Variations in Oak.** *Wood* 4, 1939 (272–4).

Local environmental conditions determine the growth rate and texture of the wood of any species and this should be recognized in classifying wood quality, rather than using broad geographical divisions. Wide annual rings and high proportion of summer wood in ring-porous hardwoods indicates a coarse, heavy wood that will be difficult to season and work.

31.22.1. YATSENKO-KHMELEVSKY, A. A. **'Physiological drying' of Beech timber.** *C.R. Acad. Sci. U.R.S.S.* 20, 1938 (185–8). [F.] P.R.

Experiments by the Tiflis Forestry Research Institute showed that early summer girdling of Beech, by sawing at the base to a depth of one-third of the radius of the trees, had almost no influence on the moisture content of the timber felled 3 months after girdling. On the other hand, a decrease of moisture from 65–75 to 40–45 per cent. took place in felled trees, the crowns of which had been left more or less intact for 2 to 3 months after felling. This desiccation caused a reduction of the specific weight from 0·98 to 0·75–0·76.

31.22.1 : 07.7. **New type moisture meter.** *Sth. Lumberm.* 159, No. 1999. 1939 (56). P.R.

Newly developed Wheatstone bridge employed in 'Megabridge' device is adapted to very high resistance measurements. This is a rugged, compact, self-contained unit.

31.22.1 : 07.7. TUOMOLA, T. Ohmiseen **vastus**-mittaukseen perustuva puun vesipitoisuuden maarays **[Determination of the moisture content of wood based on the measurement of its resistance in ohms].** *Finsk. PappTidskr.* 21, 1939 (94–7, 137–42, 180–3). [Fi.e.]

The moisture content of sawn timber, in which moisture is normally unevenly distributed, may be determined with sufficient precision by means of tag electrodes. In addition to allowances for temperature, consideration must also be given to the relation between thickness of the wood and different lengths of tag, and the use of correction factors, or measuring scales. 'The conclusion seems to be that although the moisture content measurers based on the ohm resistance have various disadvantages which restrict their general use, their advantages for certain practical purposes are so obvious that their present price should not be discouraging.' *From author's summary.*

31.22.2 : 31.23 : 12.26.22. PAUL, B. H. **Shrinkage of White Oak as affected by position in the tree.** *J. For.* 37, 1939 (572–3). [Forest Products Laboratory, Madison, U.S.A.]

In old-growth White Oak shrinkage increases progressively from the circumference to the centre to a maximum of 30 per cent., being highest near the centre of the lower part of old trees. Second-growth trees of this species show a much smaller range of shrinkage and no marked radial variation. The region of maximum shrinkage in these latter trees was found to be just above the stump. Both types of tree have an average volumetric shrinkage of about 17 per cent., while the specific gravity of the second-growth wood averages 12 per cent. heavier than that of the old growth.

31.22.2 : 31.23 : 12.26.22. STRYLA, S. **Investigations on the relationship between total volume shrinkage in Pedunculate Oak [*Quercus pedunculata* Ehrh.] and its specific weight [apparent density].** *Roczn. Nauk rol.* 46, 1939 (428–40). [Pol. f.] P.R.

The coefficient of correlation obtained in tests at Posnan was +0·2.

31.23 : 31.13 : 12.25.53. PAUL, B. H. **Variation in the specific gravity of the springwood and summer wood of four species of Southern Pines.** *J. For.* 37, 1939 (478–82). [Forest Products Laboratory, Madison, U.S.A.]

Variability curves are based upon green

volumes, as determined by means of a Breuil mercury volumeter, and oven-dry weights. The specific gravity of summerwood was found to be more variable than that of springwood except in the case of Longleaf Pine. The following average specific-gravity values were obtained:

	Springwood	*Summerwood*
Shortleaf Pine	0·265	0·600
Slash Pine	0·275	0·570
Longleaf Pine	0·280	0·690
Loblolly Pine	0·310	0·625

The specific-gravity gradient from pith to bark increases for summerwood and is fairly uniform for springwood. It decreases for both types of wood from the butt to the top of the tree.

31.25 : 12.28.47. Bromley, R. F., and Rudge, E. A. **The hardness of Teak in relation to its mineral constituents.** *Chem. Ind. Rev.* 58, 1939 (279–80). P.R.

In the 10 samples of Teak examined, there is no connexion between hardness of 'workability' and the factors attributed to it in the literature, viz. silica, apatite, 'grit', or benzene-soluble resins. It is concluded, therefore, that hardness in Teak is not attributable to any constituent in the wood that can be determined by ordinary analytical methods. Although no direct conclusions may be drawn as to the cause of hardness in Teak, it appears probable that it is due to some histological factor, closeness of grain, cell structure, or fibre orientation. *Author's summary.*

31.25 : 12.25.53 (43.8). Stryla, S. **Investigations on the hardness of Scots Pine [*Pinus sylvestris* L.] timber as tested by Brinell's ball.** *Roczn. Nauk rol.* 46, 1939 (441–90). [Pol.f.] P.R.

The testing of 3,888 specimens at Posnan revealed a distinct relationship between hardness and position in the stem.

31.27 : 12.25.54. Schonbach, H. **Research on impact bending of Larch wood.** *Holz* 2, 1939 (229–35). [G.g.]

Resistance to impact bending increases with the density of the Larch timber, the increase being slow in the lower density grades and relatively fast in those of high density. On the average, sapwood is more resistant than heartwood. Ring width, the proportion of late wood, and the site of origin of the timber does not appear to affect toughness ('dynamische Festigkeit'), which is clearly indicated by the aspect of the breakage, 'splintery' breaks being correlated with toughness and 'smooth' ones with brittleness.

31.27 : 31.13 : 12.25.53. Garland, H. **A microscopic study of coniferous wood in relation to its strength properties.** *Repr.* from *Ann. Mo. bot. Gdn.* 26, 1939. pp. 95. [American Creosoting Company, Louisville, Kentucky.] P.R.

The species studied were *Pinus echinata* Mill. and *Pinus taeda* L.

31.27 : 31.8 : 12.25.53. Chaplin, C. J., and Nevard, E. H. **Strength tests of structural timbers: Pt. 4: The development of a minimum structural grade for Redwood [*Pinus sylvestris*].** *For. Prod. Res. Rec., Lond.* No. 28 [*Timber Mechanics Series* No. 4] 1939. pp. 12.

Timber that is to be used where strength is essential should be graded accordingly, the grading to be based on a knowledge of the relation between size of defect and strength, and on the determination of the size of defect that can be used with a given working stress. Data are presented on an investigation into the relationship between size of knot and the strength and stiffness of Redwood (*Pinus sylvestris*) joists. This information, together with data on other qualities and defects, was used in preparing a tentative specification for that grade of Redwood having an extreme fibre-stress in bending of 800 lb./sq. in.

31.3. *Chemical Properties*

31.3. Müller, O. A. **Lignin and humin.** Second communication. *Papierfabrikant* 37, 1939 (221–6). [G.] P.R.

Considerable similarities are shown to exist in the composition of lignin and humin, and in the ethyl alcoholic nitration of levulose and furfurol humins on the one hand, and of Spruce, Beech, and straw on the other.

31.3 : 12.11.11 : 12.14.9. Hibbert, H. **The structure of lignin and the nature of plant synthesis.** *Repr.* from *J. amer. chem. Soc.* 61, 1939 (725–31). P.R.

31.3 : 12.14.8 : 12.25.53. Lehmann, E., and Eisenhuth, F. **Investigations on Pine bark [I].** *Ber. dtsch. chem. Ges.* 72, 1939 (1003–11). [G.] P.R.

Technique and results of chemical analysis.

31.3 : 12.14.9. HILPERT, R. S., KRUGER, W., and HECHLER, G. **The effect of nitric acid on timbers. A contribution to the chemistry of lignin.** *Ber. dtsch. chem. Ges.* 72, 1939 (1075–82). [G.] P.R.

31.3 : 12.14.9. PENISTON, Q. P., MCCARTHY, J. L., and HIBBERT, H. **The reconversion of an 'extracted' lignin into its primary building units.** *Repr.* from *J. amer. chem. Soc.* 61, 1939 (530). P.R.

31.3 : 12.25.52 : 12.26.73. BRICKMAN, L., PYLE, J. J., and HIBBERT, H. **The aldehydic constituents from the ethanolysis of Spruce and Maple woods.** *Repr.* from *J. amer. chem. Soc.* 61, 1939 (523). P.R.

31.3 : 12.25.52. CRAMER, A. B., HUNTER, M. J., and HIBBERT, H. **The ethanolysis of Spruce wood.** *Repr.* from *J. amer. chem. Soc.* 61, 1939 (509–16). P.R.

31.3 : 12.26.22. O'DWYER, M. H. **The hemicelluloses of the wood of English Oak. IV.** The structure of hemicellulose A. *Repr.* from *Bio-chem. J.* 33, 1939 (713–17). P.R.

31.3 : 12.26.73. HUNTER, M. J., CRAMER, A. B., and HIBBERT, H. **The ethanolysis of Maple wood.** *Repr.* from *J. amer. chem. Soc.* 61, 1939 (516–20). P.R.

31.3 : 33.32. RUNKEL, R. **The chemical investigation of colonial woods with special reference to the manufacture of cellulose.** *Kolonialforstl. Mitt.* 2, 1939 (65–73). [G.g.]

A general discussion. Important problems include the development of extraction processes that permit the utilization of short-fibred celluloses from broad-leaved trees in the manufacture of paper; the utilization of pentosan; the preparation of 'fibre concentrates' (products intermediate between wood and cellulose) from timbers of low density, with a view to diminishing freight costs; and the utilization of mixtures of fibres from different species.

31.4. *Lasting Qualities. Durability. Decomposition*

31.4 : 33.13. STEWART, J. K. **Wood for chemical needs.** *Chem. metall. Engng.* 45 (612, 662). P.R.

The following woods have little absorption capacity for cold solutions, as measured by volume of solution absorbed: Redwood, Spruce, Douglas Fir and Oregon Pine, Cypress, Yellow Pine, White Oak, and Sugar Maple. For hot solutions: Oak, Maple, Oregon Pine, Redwood, Yellow Pine and Spruce, and Cypress. These species are arranged in order of increasing capacity. Douglas Fir, Maple, and Cypress yield least colouring matter to solutions and such woods should be used when dealing with acetic acids. Redwood, Maple, and Cypress impart the least taste to solutions.

The following woods show little temporary change in volume when in contact with cold solutions, beginning with the least affected: Redwood, Yellow Pine, Spruce, Oregon Pine, Cypress, Fir, Maple, Oak. With hot solutions: Redwood, Yellow Pine, Spruce, Oregon Pine, Fir, Cypress, Maple, and Oak. It appears that woods are less affected by acids and acid solutions than by strong alkaline or caustic solutions. Strong oxidizing agents destroy the structure of wood. The reaction of solutions on wood varies with temperature. Tables are included to show the effect of various hot and cold solutions of different strengths on the wood of the species named.

31.42 : 31.8 : 31.4 : 01.6. **List of publications relating to fungous defects in forest products including decay in trees.** U.S.D.A., Divn. of Forest Pathology, Bureau of Plant Industry, in co-operation with the Forest Products Laboratory, Madison, Wisconsin. 1937. pp. 20.

31.42.1 : 12.25.52. YATSENKO-KHMELEVSKY, A. A. **An anatomical study on the propagation of hyphae of fungi in the dead wood of Oriental Spruce [*Picea orientalis* Carr.].** *C.R. Acad. Sci. U.R.S.S.* 22, 1939 (45–8). [F.] P.R.

31.42.1 : 12.25.53. FINDLAY, W. P. K. **Effect of sap-stain on the properties of timber: II. Effect of sap-stain on the decay-resistance of Pine sapwood.** *Forestry* 13, 1939 (59–67).

Using loss in dry weight per cent. as a criterion, experimental evidence indicates that sapwood of Scots Pine and Corsican Pine infected with blue stain is more susceptible to attack by certain wood-destroying fungi, particularly *Merulius lacrymans*, than is sound wood. However, the difference is not sufficient to be of practical significance. Tests of comparative water absorption showed that blue-stained sapwood has a greater porosity than sound wood—

a factor that would facilitate rapid diffusion of moisture, gases, and enzymes, and is believed to be important in determining the rate of decay.

31.42.1 : 31.27 : 12.25.53. JALAVA, M. Sinistymän vaikutus männyn lujuusominaisuuksiin. [**Effect of blue stain on the strength of Pine timber.**] *Puutek. tutkim. Kannatu. Tech. Publ.* No. 8. Foundation of Forest Products Research of Finland. 1938. pp. 24. [P.R.]

All standard tests, except that of impact bending, were applied to a large number of artificially stained test pieces and an equal number of unstained controls, each piece having a high proportion of sapwood. A comparison of the results indicates that 'the effect of blue stain on the strength of Pine timber can't be of any practical importance'.

31.42.1 . 33.36. LUNDBERG, G. Kampen mot blåytan. [**The control of sap stain.**] *Skogsägaren* 15, 1939 (110–14). [Sw.]

A brief account is given of the conditions that favour the development of sap-stain fungi. The optimum air and moisture content for fungal growth in wood is reached at a little above fibre saturation point, i.e. at about 35–40 per cent. moisture. Temperatures above 42° C. and below 2–3° C. inhibit the growth of the fungi, and temperatures above 46–48° C. are lethal. Short of treating the wood with fungicides, the best means of control lies in adjusting the moisture content during storage and in selecting for conversion a season unfavourable to the fungi. Round timber of large dimensions should be stored under conditions that keep the moisture content well above the danger point, either by water storage or by stacking unbarked logs in close piles in a moist, shady place. Pulpwood and small dimensions in general are best protected by the reverse method of inducing rapid drying by storage of the barked wood in open, well-ventilated stacks. Owing to the risk of infection, conversion should not be undertaken during the hot summer months, but should take place, so far as possible, in early spring, when conditions are least favourable to fungal infection and development and most conducive to rapid drying of the wood.

31.42.1 : 33.32 (47.1). WEGELIUS, T. Om röta i sulfitved och dess inverkan på fabrikations-processen och massautbytet. [**Sulphite wood decay and its influence on the manufacturing process and pulp yield.**] *Finsk PappTidskr.* 1938 (125–6, 128–30, 594, 595–8). R.A.M. 18 (564).

The loss of coniferous wood on sorting the chips prior to processing in Finnish paper mills was much higher in material damaged by fungal rots than in sound wood, mainly owing to the profusion of fine particles in the softened chips. Damaged wood gave reduced pulp yields and impaired the quality of the products. The degree of decomposition did not noticeably affect the cellulose, lignin, pentosan, resin, and fatty-substance contents of the pulp, but the amount of ash rose with increasing deterioration. A comparison of the α-, β-, γ-cellulose contents of wood in different conditions of soundness indicated that fungal disintegration involves a fall in the α- and a corresponding rise in the β-cellulose contents of the wood.

31.42.1 : 12.26.22 : 12.25.52 (489). BUCHWALD, N. F. Rødkærnet Bøgetræs Modstandsevne mod Tømmersvampe. [**The resistance of red-hearted Beech wood to wood-rotting fungi.**] *Dansk Skovforen. Tidsskr.* 1939 (238–51). [Da.da.]

Resistance to fungal decay was studied in white- and red-hearted Beech wood, and Norway Spruce was also tested for comparison. Both normal Beech wood and Norway Spruce wood were severely decayed by *Merulius lacrymans*, *Coniophora cerebella*, and *Polyporus vaporarius*. No marked difference in resistance was noticeable between the two tree species. After 7½ months' exposure to attack, the wood samples lost 42–48 per cent. of their initial weight from *M. lacrymans*, 31–37 per cent. from *C. cerebella*, and about 22 per cent. from *P. vaporarius*. This agrees with the finding of Liese and Stamer that in Scots Pine the same fungi caused losses of 45, 35, and 22 per cent. respectively after 6 months' exposure to attack. In the initial stages *C. cerebella* and *P. vaporarius* attacked wood more severely than *M. lacrymans*, but after about 5 months their attack decreased in intensity and that of *M. lacrymans* became accelerated. Unimpregnated red-hearted Beech wood was decayed by all three fungi, but suffered less than white-hearted wood, the respective losses in weight being 17–29 and 22–48 per cent. after 7½ months. Impregnated wood of both types underwent little decomposition, the loss over 7½ months being only 5–8 per cent. Impregnated white-hearted Beech, however, seemed a little more resistant than impregnated red-hearted Beech.

31.42.1 : 12.27.39 (91.4). YOLORES, B. R. **Extent of defects of some Dipterocarp species in Northern, Central, and Southeastern Luzon.** *Philipp. J. For.* 2, 1939 (185–99).

Data on losses of Dipterocarp timber, traceable to fungi, are presented by species and type of defect. The losses ranged from 5 to 31 per cent. of the log volume and were generally greater in regions without a pronounced dry season.

31.42.1 : 12.21 (91.4). RAMIREZ, I. ***Schizophyllum commune* Fr.—a forest-products-rotting fungus.** *Philipp. J. For.* 2, 1939 (121–41).

31.43.2 : 13.21.85.67.1. SCHUCH, K. **On the control of *Hylotrupes bajulus* L.** *Holz* 2, 1939 (235–8). [G.g.]

Practical methods for examining the extent and development of the damage caused by this insect are outlined. An important factor is the time elapsed since the felling of the timber, the newer wood being much more vulnerable. Control measures for this insect are fairly expensive.

31.43.2 : 45.3 : 13.21.85 (79.5 : 79.7). FURNISS, R. L. **Insects attacking forest products and shade trees in Washington and Oregon in 1937.** *Proc. ent. Soc. B.C.* No. 35, 1939 (5-8).

31.7. *Specially Valuable Properties. Quality Timbers*

31.73 : 31.21.32. **Figure in timber.** *Circ. For. Prod. Aust.* No. 43. Govt. Printer, Melbourne. 1939. pp. 22.

The natural factors that contribute to the production of figure in wood, and the methods of utilizing figure to advantage.

32. HARVESTING OF WOOD. LOGGING

32 : 33 (66). AUBRÉVILLE. **The complete utilization of the tropical woods of West Africa.** *Rev. Eaux For.* 77, 1939 (485–95, 599–608). [F.]

The economic future of French West Africa's timbers.

32 : 37.9 : 24.21 (77.5). DELANEY, R. **Selective logging costs less.** *J. For.* 37, 1939 (522–4). [Menominee Indian Reservation, Wisconsin.]

Light selective logging with a short cutting cycle and the use of truck transport was found to be less costly than railroad transportation and the heavy, infrequent cutting that is necessary to liquidate the investment in this type of transport. In the operations that were compared for this analysis the factors of cull, compactness of stand, and wages favoured the second type of operation to some extent. The light cutting, truck operation showed a total saving of $2.29 per M. feet divided as follows: woods $1.18, transportation $1.07, and overhead $0.04. Saving in woods operation resulted mainly from handling only the larger logs. Other advantages of this method were noted.

32.1. LIEFELD, T. A. **Marking and numbering trees with paint in stick form.** *J. For.* 37, 1939 (584–5).

A commercial product called 'Markal' gave very satisfactory results.

32.1 : 07.7. POND, J. D. **Additional notes on marking trees with spring spray guns.** *J. For.* 37, 1939 (656).

Using a half-pint oil-can with ejection power to carry ten feet, and a 50-50 mixture of paint and kerosene. Efficient, durable, and does not clog.

32.2 : 31.22 : 12.26.22. KNUCHEL, H. **The influence of time of felling on the properties of Beech wood.** *Schweiz. Z. Forstw.* 90, 1939 (158–69). [G.g.]

Investigations at Zürich on numerous specimens of Beech wood taken from different heights of individual trees 100 to 200 years old. The moisture content of the inner annual rings is lower in winter than in summer, while for the outer rings the opposite condition is true. The process of drying Beech wood, both in the open under a roof and under controlled atmospheric conditions, did not appear to be influenced by the season of felling.

32.2 : 32.5 : 91.8 (488). UNDÉN, N. Sommaravverkningar inom det norrländska skogsbruket. **[Summer fellings in Norrland forestry practice.]** *Skogen* 26, 1939 (203–4). [Sw.]

It is claimed that in Norrland summer felling of pulpwood is in many ways more economical than winter felling. Felling, barking, scaling, haulage, and floating costs are lower; and the work involved in these operations can be spread more evenly over the year, to the advantage of forest workers who are often only seasonally

employed. In the author's experience pulpwood can be cut throughout the summer without serious risk of degrade, provided that stacking is carried out with due care.

32.21 (71.4). BUBIE, W. L. **Cut control of logging operations.** *For. Chron.* 15, 1939 (69–75).

A system of operating as practised in Quebec. This includes work preliminary to actual logging such as preparation of maps, timber estimates and periodic and annual cutting plans, and the collection of all relevant data. The duties of an inspector are detailed, and cutting methods, utilization, and check scaling are briefly discussed.

32.23. **Felling and bucking with power saw.** *Timberman* 40, 1939 (44–6).

A gasoline power saw that will cut trees of diameters of over twice the length of the blade. A 4-ft. diameter tree can be undercut and felled in from 12 to 15 minutes using this saw.

32.23. BALE, A. P. **Power felling and extraction.** *Wood* 4, 1939 (314–16).

The relatively high efficiency of power saws and modern power equipment for skidding and hauling.

32.23 : 37.1 (71). TOWNSEND, C. R. **Mechanized logging.** Woodlands Section, Canadian Pulp and Paper Association, Montreal. 1938. pp. 90.

Data on functions, costs, and relative efficiency of various mechanized units used in cable logging, tractor logging, and truck logging, and in various related operations as sawing, loading, hauling, &c.

33. CONVERSION. PRESERVATION. FASHIONING OF WOOD

33 : 01.6. **Bibliography on the machining of wood.** The American Society of Mechanical Engineers, 29 West 39th Street, New York. 1939. pp. 74.

33 : 01.6. **List of publications on wood-finishing subjects.** U.S.D.A., Forest Service, Forest Products Laboratory, Madison, Wisconsin. 1939. pp. 14.

33.15. Veneers. Plywood. Gluing

33.15. **Glue stains.** *Wood Information Series* No. 49. Timber Commission for Eastern Canada, 2 Cockspur Street, London, S.W. 1. 1939. p. 1.

The use of thick veneers and woods with small pores generally prevents such staining, as does a proper correlation between the consistency of glue and the pressure to be applied.

33.15. SAUER, E. **A process for testing high-quality glues.** *Holztechnik* 19, 1939 (167–72). [G.g.] P.R.

The object was to determine the tensile strength of glued joints made with Beech test pieces of standard dimensions, and known moisture content. Joints were made on the ends of the test pieces, since in joints parallel to the wood fibres the glue is stronger than the wood. The test pieces employed measured 10 × 10 × 70 mm., giving a joint area of 1 sq. cm. Moisture content was controlled by placing the test pieces in closed vessels over saturated solutions of salts of known vapour pressure and weighing at intervals until no further change occurred. The most suitable moisture content for testing was 55 per cent. and was obtained by storage over a saturated solution of calcium nitrate.

33.15 : 33.31. BROUSE, D. **Exposure tests on plywood.** *Mech. Engng., N.Y.* 60, 1938 (852–6). P.R.

Joints made with different artificial resin glues of the phenolic type have satisfactorily withstood 4 years of exposure to extremely severe test conditions. These glues did not appear to soften or hydrolyse on continuous soaking in water and the joints were not affected by molds although the presence of the mold-resistant glue line did not protect the wood itself from the action of wood-destroying fungi. After 4 years of soaking and drying the specimens still developed a high percentage of wood failure in test.

The one vinyl ester included appeared to be sufficiently resistant to hydrolysis and to mold attack but lacked the strength required to withstand stresses caused by repeated wetting and drying.

Previous experiments with the older wood-working glues were confirmed in that: (*a*) the bloodglue containing paraformaldehyde was sufficiently resistant to molds and hydrolysis but it lacked the strength to withstand indefinitely the mechanical stresses set up by repeated wetting and drying; (*b*) casein glues were readily subject to failure from hydrolysis, mold action, and mechanical stresses when the

glue was softened by absorption of water. *Author's summary.*

33.15 : 09.4 (497.2). BULGARIA. **The Bulgarian veneer and plywood industry.** *Rev. int. Bois* 6, 1939 (207–13). [F.]

The industry is only 10 years old but is rapidly developing. Exports already exceed imports. Very fine veneer is produced from Bulgarian Walnut.

33.21. Tools. Implements. Machines

33.21. PLAMBECK, H. **New safety devices for planing machines.** *Holztechnik* 19, 1939 (214–15). [G.] P.R.

33.32. Cellulose. Paper manufacture

33.32. ESOURRON, R. Les divers emplois du bois et de la cellulose. [**The various uses for wood and cellulose.**] *Chim. et Industr.* 41, 1939 (861–76). P.R.

33.32 : 31.3. BEAZLEY, W. B., JOHNSTON, H. W., and MAASS, O. **The penetration into wood of cooking liquors and other media.** *Bull. Dom. For. Serv.* 95. Govt. Printer, Ottawa. 1939. pp. 48.

The effect of the following factors on natural penetration is discussed: chip shape, concentration of the electrolyte, density, and temperature. The worst shape varies with different media and suggests that the cell-wall offers considerable resistance to neutral and acid solutions but not to basic solutions; the sorption of free sulphur dioxide is about 4 times as great as that of combined sulphur dioxide and in both cases the temperature coefficient is negative; concentrations above a certain specific figure have no effect on the rate of diffusion; density has no influence on the rate of sodium hydroxide diffusion.

Forced penetration: the flow of liquids through wood takes place through the tracheids and there is no evidence of tori acting as valves and thus setting an upper limit to the pressure. The rate of penetration is characteristic of the species of wood. The rate of flow increases more rapidly than in direct proportion to the pressure, and an increase in temperature causes a greater increase in rate than that predicted by temperature-viscosity relationships. The flow through sapwood is much greater than through heartwood of the same species, and the permeability in the longitudinal direction is very much greater than in other structural directions. The rate of penetration decreases more rapidly than in inverse ratio to the thickness, and a great decrease in rate is caused by the swelling of the wood due to wetting.

Some practical experiments of direct interest to the pulp and paper industry are described. There is a decided decrease in rate of penetration of solutions that liberate gas within the chip. There are two types of 'burning'; the first results from faulty penetration at the beginning of the cook, the second, which occurs at the end of the cook, depends on the duration of heating after the disappearance of available lime. Under certain conditions penetration is hindered by the plugging effect of crystals of calcium monosulphite, particularly at the surface of the wood; the effect is in inverse proportion to the density of the wood, and this is attributed to differences in the pitting.

33.32 : 32.31.3 (44). DUTILLOY, P. **Progress in the utilization of French pulp-woods.** *Bull. Soc. for. Franche-Comté.* 23, 1939 (61–6). [F.]

The progress made since the creation in 1936 of the 'Convention des Bois de Papeterie et Pâtes de cellulose' is reviewed with reference to timber consumption, improvements in the quality and changes in price of the raw materials.

33.32 : 32.7 (73). HALL, J. A. **The slab pile and logging waste.** *J. For.* 37, 1939 (528–30).

The cellulose content of wood and the use value of wood are not necessarily the same. The strength, weight, resilience, &c. of wood is not transferred to synthetic boards. Proper management should see that high quality wood continues to be grown to supply the lumber market, while thinnings, and logging and milling waste can be used to supply the cellulose market. A discussion of the possible requirements of cellulose and wood for some synthetic products as compared with present lumber requirements.

33.32 : 12.25.53 (76.2). BULL, H. **Loblolly Pine *versus* cotton: a comparison of annual cellulose production per acre.** *J. For.* 37, 1939 (570–1).

On Arkansas soils which are only moderately productive for cotton, Loblolly Pine produces at present about 4·5 times as much cellulose per acre as does cotton.

33.32 (94). COHEN, W. E., and DADSWELL, H. E. **The production of fibres rich in**

hemicelluloses by controlled delignification of Australian hardwoods. *J. Coun. Sci. industr. Res. Aust.* 12, 1939 (115–27). P.R.

33.36. Preservation of wood

33.36. HUNT, G. M. **Wood preservatives and their application.** *Pests* 7, 1939 (9–13). P.R.

33.36. KNIGHT, R. A. G., and DEAN, A. R. **Tackling the Builder's Problems. Comparative resistance of some coatings applied to wood.** *Ill. Carp. Build.* 125, 1939 (454). P.R.

Tests, using pieces of Beech ¼ in. thick, were made to determine the relative efficiency of various paints in preventing the absorption of moisture into wood over definite periods of time. The following abbreviated table shows the relative efficiency of the different paints tested for a 28-day period under the particular conditions of the test.

Paint	*No. coats*	*28-day efficiency*	*Variation*
Limed rosin medium	2	89	± ½
Bituminous paint	2	69	±1
Enamel	3	58	±2½
Oil paint [1]	3	56	±1½
Lead paint	3	45	±3
Oil paint [2]	3	44	±2½
Aluminium in bronzing liquid	2	35	±1
Shellac	2	31	±6
Copal varnish	2	20	± ½
Spar varnish	2	17	±1½
Aluminium in boiled oil	2	12	±2
Pink primer	1	14	±3
Bronzing liquid	2	6	±1½
Wax polish	2	3	±1
Boiled oil and turps	2	..	..
Raw linseed oil	1	..	..

33.36. **Testing Wood Preservatives.** U.S.D.A., Forest Service, Forest Products Laboratory, Madison, Wisconsin. December 1938. P.R.

A wood preservative that is to be of practical value must have suitable qualities in regard to toxicity, permanence in use, penetration, safety in use, effect on wood and metal, cost, supply, and for particular uses should be paintable, odourless, colourless, fire-resistant, moisture-repelling, and non-swelling. Various laboratory tests that may be used in determining these factors are discussed with particular regard to the relative value of these tests and their limitations. It is pointed out that the final evaluation of a preservative can only be made after observation of its performance in actual use over a period of years and that accelerated field tests, using stakes or saplings of small cross-section, cannot be completed hurriedly.

33.36. HUMPERDINCK, C. **Dangers to health in wood preservation.** *Holztechnik* 19, 1939 (210–11). [G.] P.R.

Medical advice for the protection of workmen.

33.36. **Ground line preservation of wood poles.** *Bulletin of the Hydro-Electric Power Commission of Ontario* 26, 1939 (187–92). P.R.

The construction and installation of a sand creosote collar for the preservation of wood poles, based on a new specification.

33.36. **Organo-mercury wood preservative.** *Paint Tech.* 4, No. 42. 1939 (217). P.R.

The use of basic methyl mercury nitrate either in aqueous solution or mixed with inert fillers, dust-binding agents, and absorbents is described by I. G. Farbenindustrie. A-G. in British Patent 492, 306.

33.36. DHALL, A. D. **Bleeding from creosoted sleepers treated by the Rueping process.** With an additional note by the Utilization Officer, Forest Research Institute. *Indian For.* 65, 1939 (349–55).

The measurement of the drip from creosoted sleepers gave the following figures:

Species	*Amount of bleeding as per cent. of the amount originally injected*	
	First 24 hours per cent.	*Total per cent.*
Deodar	28	35·5
Fir	20	24·9
Chir	4	4

It was found that bleeding increased greatly with increase in temperature and that the drip was of the same chemical composition as the preserving mixture. The cause of bleeding is thought to be related directly to the method of treatment used—that is, treatment under air pressure followed by application of vacuum to remove free oil and air. It is believed that owing to the viscosity of the oil some of the air remains in the wood and later is gradually released, forcing the preservative mixture out before it.

33.36 : 01.6. **List of publications on wood preservation.** U.S.D.A., Forest Service, Forest Products Laboratory, Madison, Wisconsin. 1939. pp. 28.

33.36 : 06.1 (73). U.S.A. **Proceedings of the 35th annual meeting of the American Wood Preservers' Association, Jan. 24–26, 1939.**—With index to the Proceedings, 1930–9 inclusive. American Wood Preservers' Association, 1427 Eye Street, N.W., Washington, D.C. 1939. pp. 503.

33.36 : 31.42.1. CHIDESTER, M. S. **Further studies on temperatures necessary to kill fungi in wood.** *Preprint* for *Proc. Amer. Wood Pres. Ass.* 1939. pp. 6. [Division of Forest Pathology, Bureau of Plant Industry, U.S.D.A.]

Studies on *Lentinus lepideus*, *Lenzites sepiaria*, *L. trabea*, *Trametes serialis*, *Fomes roseus*, and *Poria incrassata*. Of these species the first three were the most resistant, and the last-named the most sensitive to heat. The time of heating and the internal temperature required to kill fungi in green wood vary from 75 minutes at 150° F. to 5 minutes at 212° F. Experiments at lower temperatures show that attempts to sterilize wood by using temperatures under 150° F. are not to be recommended.

33.36 : 33.4 (74.8). FERGUSSON, J. A. **Comparative durability of shingles and shingle nails.** *Bull. Pa. agric. Exp. Sta.* 353. State College, Pa. 1938. pp. 25. P.R.

Tests made under favourable atmospheric conditions indicate that shingles of untreated Red Cedar and Redwood were durable for 25 years as were shingles of Southern Yellow Pine that had been treated with creosote. Shingles of treated chestnut were durable while those of treated Pitch Pine were not durable. The preservative treatment materially lengthened the life of shingles of durable wood, resulting in less warping, splitting, and surface weathering, and shingle nails lasted longer when used with treated shingles.

33.36 : 38. AUSTRALIA. **Termite [white ant] proof construction.** *Trade Circ. For. Prod. Aust.* No. 44. Acting Govt. Printer, Melbourne. 1939. pp. 14.

33.36 : 38(94). **Termite-proof construction for buildings: interesting demonstration in Adelaide.** *Aust. Timb. J.* 5, 1939 (344–5 and 391).

The method consists essentially of using galvanized iron shields, or termite barriers which are laid on the foundation walls. The cost is approximately £10 (Australian currency) for an ordinary five-roomed brick house. Once the foundations have been rendered termite-proof, any timber can be used for construction above the shields.

33.36.1. *Impregnation*

33.36.1. BERTLEFF, V. **The testing of arsenical wood preservatives.** *Holz* 2, 1939 (193–7). [G.g.]

Satisfactory results are reported on corrosion and mycological tests with 'Fluoran O.G.', a patent preservative manufactured by the 'Verein für chemiche und metallurgische Produktion', Aussig a.d.E.

33.36.1. **A method of treating articles of wood or other fibrous material.** *Complete Patent Specification* No. 16301/38. P.R.

An invention relating to the method of treating articles of wood or other fibrous material that have been impregnated with a synthetic resinous material of the phenolformaldehyde type, made hard and insoluble by curing.

33.36.1. BRAJNIKOFF, B. J. **Resin-impregnated wood.** *Chem. Prod.* 2, 1939 (71–7). P.R.

Factors affecting resinoid-impregnation; characteristics, properties, and uses of resin-impregnated wood, which has 300–500 per cent. greater strength than the untreated timber.

33.36.1 : 31.22.2. BATESON, R. G. **Sorbitol in wood treatments: further experiments on shrinkage and swelling behaviour.** *Repr.* from *Chem. Tr. J.* 105, 1939 (93–4).

It was determined that the amount of sorbitol absorbed increased with time of immersion in a 25 per cent. aqueous solution, up to 28 per cent for 175 days and that the treatment had a marked effect in reducing the movement of the wood, particularly in the radial direction, when it is exposed to a cycle of relative humidity from 30 per cent. to 90 per cent. at a constant temperature. It is suggested that the absorption of 36 per cent. sorbitol would secure complete stability in the radial direction, though 60 per cent. sorbitol might be required for tangential stability.

33.36.1 : 31.42.1 : 12.25.5(71.1). EADES, H. W. **Sap-stain and mould prevention: a study of the relative efficacy of certain chemicals on Western White Pine, Douglas Fir, and Western Hemlock.** Department of Mines and Resources, Forest Service—Lands, Parks, and

Forests Branch, Forest Products Laboratories of Canada, Vancouver Laboratory. 1939. pp. 13.

Six proprietary sap-stain and mould preventives described as (1) a mixture of sodium tetrachlorphenate and sodium 2-chlororthophenylphenate, (2) sodium pentachlorphenate, (3) ethyl mercury chloride, (4) sodium hypochlorite, (5) sodium pentachlorphenate (2 and 5 from different firms), and (6) sodium tetrachlorphenate were tested. Boards 1 in.×6 in. ×12 ft. of Western White Pine, Western Hemlock and Douglas Fir were immersed for 15 seconds in cold aqueous solutions of the preventives. The boards were sprayed with a water suspension of spores of moulds and sapstaining fungi, and close-piled. The results obtained after two months indicate that No. 3 was the most effective treatment against stain for all species, and as a preventive against mould, No. 6 was most effective for Western White Pine, Nos. 2 and 5 for Western Hemlock, and No. 1 for Douglas Fir, Nos. 1 and 6 having a high efficiency for all species.

33.36.1 : 33.4 (73). Joyce, R. **Economics of wood preservation in underground coal-mining.** *Tech. Publ. Amer. Inst. Min. Engrs.* 1067, 1939. pp. 9. R.A.M. 18 (563–4).

Data on costs and the life duration of treated and untreated timbering are wholly in favour of the former. In the case of zinc-chloride treated mine ties two renewals have been spared by the treatment, representing cash savings of $366,835 for an added first charge of $69,602.

33.36.3. *Seasoning. Drying*

33.36.3. Mathewson, J. S. **The seasoning of wood.** Forest Products Laboratory, Forest Service, U.S.D.A., Madison, Wisconsin, 1939. P.R.

A discussion of the moisture relations of wood with particular reference to the relation between atmospheric temperature and humidity and the drying of wood. The rate and direction of air flow is important in both air seasoning and kiln drying and may be controlled by construction of pile and thickness of stickers. The causes of seasoning defects are discussed and suggestions are made for preventive measures.

33.36.3. Schluter, R., and Fessel, F. **New practical experiences in the artificial seasoning of wood:** the technique of kiln-drying. *Holz* 2, 1939 (169–93). [G.g.]

Report on the kiln-drying plant of Siemens & Halske A. G. Data are given on heat economy, air movement within the kilns, resistance to air movement, diffusion of moisture, length of drying, relative air humidity and the distribution and equalization of humidity within the timber at the end of the process. Numerous tables, graphs, and drawings are included.

33.36.3 : 01.6. **List of publications on the seasoning of wood.** U.S.D.A., Forest Service, Forest Products Laboratory, Madison, Wisconsin. 1938. pp. 20.

33.36.3. **Casehardening of wood.** *Wood Information Series* No. 46. Timber Commission for Eastern Canada, 2 Cockspur Street, London, S.W.1. 1939. p. 1.

A state of unequal stress in the inner and outer portions of a piece of wood which is brought about by uneven drying. Boards resawn from such a piece will 'cup' severely. The condition can be relieved by moistening the outer shell of the wood with steam.

33.36.3. Stevens, W. C. **The importance of air-flow in timber-drying kilns.** *Timb. News Sawm. Engr.* 47, 1939 (266–7).

The speed at which the air passes through the timber piles in a kiln is closely related to the changing temperature and moisture content of the air, and so has an important effect on uniformity in rate of drying. The air speed can be measured by introducing ammonium chlorate smoke into the entering air at right angles to its flow, and noting the time elapsed until it first appears at the other side. For general purposes the rate of 2 ft. per second is most efficient for a forced circulation type of kiln.

33.36.3 : 01.6. **List of publications on the seasoning of wood.** U.S.D.A., Forest Service, Forest Products Laboratory, Madison, Wisconsin. 1938. pp. 20.

33.36.3 : 12.25.4–5 (71.1). Jenkins, J. H. **The seasoning of Douglas Fir timbers and Western Red Cedar poles:** a study of their air-seasoning rate and moisture gradient in the Southern Coast region of British Columbia. Forest Products Laboratories of Canada, Forest Service, Lands, Parks and Forests Branch, Dept. of Mines and Resources. 1939. pp. 14.

Thirty-six Douglas Fir timbers 6×6 in., 12×12 in., 24×24 in. in cross-section, and

36 Western Red Cedar pole sections were stored under maximum air-drying conditions. The average rate of drying was measured by periodic weighings. The moisture gradient was determined by means of borings until the test sections had reached the fibre saturation point, after which the moisture content at the surface, at a depth of 1 in., and at the centre of each piece was obtained by the use of an electric moisture meter.

The rate of drying of the surface layers of the timbers and poles was very rapid, reaching equilibrium with atmospheric conditions during the 1st year. The moisture gradient in the interior of the timbers and poles varied with size and period of seasoning, equilibrium being reached at the centre of the smaller sections within the first 2 years. The moisture content in the centre of the 43-in. circumference poles reached equilibrium at the beginning of the 5th year; the 24-in. Douglas Fir timbers, however, still showed 4 to 5 per cent. moisture gradient between the centre and 1 in. below the surface at the end of the 5th year. *From author's summary.*

33.36.3 (79). STEEL, J. **Low pressure steam kilns.** *Timberman* 40, 1939 (20–6).

Recent improvements in kiln construction have made possible the utilization of exhaust steam as an economical source of heat.

33.36.3 (91). THOMAS, A. V. **The seasoning of timber.** *Malay. Forester* 8, 1939 (96–102).

Air seasoning is being used to some extent in Malaya though local methods are inefficient and seasoned timber is difficult to obtain. The proper method for air-drying timber is described. While air temperature cannot be controlled, air movement, and indirectly and to some degree air humidity, can be regulated by adjusting height of stickers between layers of timber, by controlling the distance between piles, and by sheltering the timber. Proper methods of supporting and stacking timber of various kinds and sizes are described and also methods for preventing end-splitting. The degree and rate of drying is considered for various species and sizes of timber. The desired moisture content of the seasoned wood is closely related to the climate of the locality in which it will be used. Shrinkage and swelling subsequent to seasoning may be reduced by using quarter-sawn timber and sealing the surface of the wood with a non-porous material.

33.38. Charcoal manufacture. Charcoal. Use of wood in power-gas generators

33.38. DONALD, G. H. **The manufacture of charcoal in portable kilns.** *For. Prod. Res. Rec., Lond.* No. 29. 1939. pp. 20.

The description of a small portable steel kiln and the methods of loading and burning the charge to obtain relatively high-grade charcoal. The minimum dimension of the wood used should not exceed 7 in. The wood should be peeled only in the production of a special high-grade charcoal. Preliminary reduction of wood moisture and the close stacking of the billets increases the efficiency of the kiln. More even burning is obtained by regulating air flow by means of outlet flues only. Local draughts can be controlled through proper adjustment of these flues. When the discharging smoke turns blue the kiln should not be closed down; a direct draught should be created by proper adjustment of the vents, thus raising the temperature of the kiln and driving off the residual volatile tarry matter. When this is completed the kiln should be closed and carefully sealed.

33.38. DONALD, G. H. **Charcoal burning in small portable kilns.** *Emp. For. J.* 18, 1939 (95–100).

An investigation into methods of producing charcoal with a low volatile content. The portable kiln used and method of operation are described briefly. Results so far indicate that wood should be pre-dried as far as possible and roughly sorted by size so that the billets of any one charge are fairly uniform and with a diameter of not more than six inches. Rate of carbonization can best be controlled by regulating the movement of outgoing smoke, rather than the incoming air, by means of dampers at the top of the outlet flues. A final heating up or 'flash up' at which the temperature of the kiln is kept at 600° to 700° C. for 15 minutes will drive off most of the volatile matter which remains in the charcoal after carbonization at comparatively low temperatures.

33.38. DONALD, G. H. **Running lorries on wood-gas.** *Repr.* from *Estate Mag.* 39, 1939 (32–5).

12 lb. of charcoal or 24 lb. of wood of not more than 20 per cent. moisture content are equivalent to one gallon of petrol. Charcoal should be of correct size and quality. Wood should have maximum dimension of 3 in. and

be at least 50 per cent. hardwood. In an adapted vehicle power is reduced by 25 to 30 per cent. Cleaning requires about 1 hour per 500 miles.

33.38 (485). HESTDALEN, L. F. Trekull som motorbrensel: hvad Sverige hittil har opnådd **[Charcoal as motor fuel: what Sweden has achieved up to date].** *Tidsskr. Skogbr.* 47, 1939 (161–73). [Nor.]

33.38 (485). **Charcoal gas fuel: charcoal 'nuts'.** *Austr. Timb. J.* 5, 1939 (353).

Notes from a Swedish factory indicate that successful experiments have been made in the manufacture of charcoal 'nuts' of 100 per cent. charcoal, using low-grade tar as a binder. The tar is fully recovered and used repeatedly. These 'nuts' appear to have twice the efficiency of ordinary charcoal per unit of volume and are for use in relatively heavy motor vehicles. There is no loss of dust or particles in manufacture such as results from the crushing of ordinary charcoal to a usable size. The proposed output is to be 15,000 tons a year and the necessary equipment will cost £4,000.

33.6. *Packing*

33.6 (73). NEUBRECH, W. LE R. **American wooden boxes and crates.** *U.S. Dep. of Commerce, Bureau of Foreign and Domestic Commerce, Trade Promotion Series* No. 188. Supt. of Documents, Washington, D.C. 1938. pp. 35.

Types of boxes for different uses. The species and quantity of wood used in the manufacture of boxes and crates in the United States and in export as box shooks.

33.8. *Other Fashioning of Wood*

33.8. **Wood in aircraft.** *Aust. Timb. J.* 5, 1939 (91–5, 133).

33.8 : 01.6. **List of reports and publications on the use of wood in aircraft construction.** U.S.D.A., Forest Service, Forest Products Laboratory, Madison, Wisconsin. 1937. pp. 15.

33.8 : 33.15 (43). KÜCH, W. **Research on wood, plywood, and laminated wooden structures with reference to their use in aeroplane construction.** *Holz* 2, 1939 (257–72). [G.g.]

34. MINOR FOREST PRODUCTS AND THEIR UTILIZATION

34.23 : 33.16. THOMAS, J. O. **The manufacture of wood flour.** *Wood* 4, 1939 (207–10).

Description of a plant installed by Messrs. J. O. Grant & Co., Ltd., Manchester.

34.25. **The world's Cinchona bark industry. II. The present position of the production of Cinchona bark and quinine in the Empire countries.** *Bull. imp. Inst., Lond.*, 37, 1939 (183–96).

A summary of the position in regard to Cinchona cultivation in various Empire and foreign countries where the tree has been introduced. The most promising of the Empire countries are Tanganyika, the Cameroons under British Mandate, and Malaya.

34.26. HALL, S. J. **The place of naval stores operations in forest management.** *J. For.* 37, 1939 (544–6).

Combining the desirable features of turpentining and wood production. Methods of handling an operation with particular reference to the problem of efficient and stable labour.

34.26 : 12.25.4. MOUSSERON, M., GRANGER, R., and RONAYROUX, M. **On the composition of the essential and pyrogenous oils of *Juniperus oxycedrus* L.** *C. R. Acad. Sci. Paris* 208, 1939 (1411–13). [F.] P.R.

34.26 : 12.27.82. KOMISSAROV, D. A. ***Euonymus verrucosa* as a source of gutta-percha, and the method of determining the gutta-percha content.** *Sbornik Trudov Beresklet* 1938 (167–80). [R.e.] The U.S.S.R. Central Forestry Research Institute, Leningrad.

34.26 : 12.27.82 (47.9). STRATONOVITCH, A. I. ***Euonymus* in the North Caucasus and new possibilities of solving the problem of Soviet sources of gutta-percha.** *Sbornik Trudov Beresklet* 1938 (87–118). [R.e.] The U.S.S.R. Central Forestry Research Institute, Leningrad.

34.26 (495). GREECE. **Resin products in Greece.** *Rev. int. Bois* 6, 1939 (214–17). [F.]

34.26 (66.9). ZEHMEN, H. VON. **Investigation of 7 copals from the Cameroons.** *Kolonialforstl. Mitt.* 1, 1939 (472–4). [G.g.]

34.39. BHATTACHARYA, R., and HEATH, G. D. **Fibrous lac.** *Tech. Pap. Lond. Shellac Res. Bur.* No. 18. London Shellac Research Bureau.

India House, Aldwych, London, W.C.2. 1939. pp. 14.

35. SALE AND DISPOSAL OF FOREST PRODUCTS

35 : 98 (71.6). BIGELOW, J. R. **A program of co-operative marketing of woodlot products for Nova Scotia.** *For. Chron.* 15, 1939 (119–21). [Department of Agriculture, Nova Scotia.]

The organization of primary producers to improve by co-operation the distribution of material, and to raise the quality standard of production in keeping with market requirements.

35 : 98.1 (74.2). BALDWIN, H. I. **Marketing cordwood in New Hampshire.** *J. For.* 37, 1939 (474–7).

The cordwood market is relatively stable and provides an outlet for low-quality material in small lots as well as in large quantities.

35 : 98 : 09.4 (75–6). WINTERS, R. K. **Fuelwood consumption in the Lower South.** *J. For.* 37, 1939 (445–8).

The methods used for surveying the quantity and kind of fuelwood used residentially and commercially by the rural farm, rural nonfarm, and urban population of the southern United States, and a summary of the data obtained. The annual consumption of fuelwood in the area surveyed, from Florida to Oklahoma, is estimated at 22·3 million cords, of which 10·6 million cords are Pine and 11·7 million cords are hardwood. Of this about 8·9 million cords are a direct drain on the forest, the remainder being cull or deadwood.

35.1 : 33.4. SORENSEN, C. J. **Grading peeler logs and blocks.** *Timberman* 40, 1939 (52).

35.1 : 98. HICKS, W. T. **Economic aspects of co-operative marketing of forest products.** *J. For.* 37, 1939 (392–4).

A discussion of certain features of co-operative societies with regard to the possible use of this kind of organization in forestry, especially in the grading of forest products and the management of forest land.

35 : 1 (73). WINSLOW, C. P. **Sustained markets as a vital factor in logging: some research trends.** *Int. Rev. Timb. Util.* 4, 1939 (29–34).

A discussion of some current research projects that are closely related to the development of the industry. These include the use of Douglas Fir as pulpwood; the utilization of small-size, low-grade, and waste wood in the manufacture of plastics; the use of lignin; chemicals used in the seasoning of wood; the manufacture of plywood.

37. FOREST TRANSPORT

37 (485). SWEDEN. **Motor transport of forest produce:** investigations carried out by the Forest Transport Committee of the Academy of Engineering Science, Stockholm. *Svenska SkogsvFören. Tidskr.* 37, 1939 (197–315). [Sw.g.]

Large-scale investigations, under normal Swedish transport conditions, of various types of lorries and their equipment, loading devices and their performances, the influence of road condition on transport, and of transport costs.

37.1 (73). COLLINS, T. W. **Evolution of logging trucks.** *Timberman* 40, 1939 (15–16, 18).

38. FOREST CONSTRUCTIONAL WORKS

38.2. VRIES, VAN B. W. DE. **Timber connectors.** *Wood* 4, 1939 (257–9).

By increasing the shear area that carries the load the strength of joints is greatly increased.

38.4. IONOV, B. D. **Friction in timber slides.** *Lesnaya Industriya, Moscow* 7, 1938 (25–6). [R.]

Measurements by means of self-recording dynamometers showed that the lubrication of dry slides with refuse oil was far more efficient in reducing friction than by wetting with water.

38.62 : 07.7. MULTAMÄKI, S. E. Skogsdikningarnas stenarbeten och stendragaren, stenkälken MI (Kivikelka MI) [**Kivikelka ('Stone sledge') MI, a patent stone lifter for forest drainage operations**]. *Skogsägaren* 15, 1939 (168–73). [Sw.]

The implement consists essentially of two strong beams braced together like sledge runners, with a hand windlass at the top end. The feet of the runners are inserted as far as possible under the stone and a steel cable is reeled out and looped round the stone, which is then hauled up along the runners by means of the windlass. Two men only are needed to operate the lifter and to carry it from place to place. Stones up to a weight of 2,000 Kg. can be dealt with. The implement has been used in Finland since 1935 and has proved useful and durable.

4. PROTECTION

42. INJURIES FROM INORGANIC AGENCIES

42.21 : 11.2 : 11.11.2 : 12.19. Day, W. R. **Local climate and the growth of trees with special reference to frost.** *Repr.* from *Quart. J. R. met. Soc.* 65, 1939 (195–209).

Vegetation types are determined largely by the general climate, factors of particular significance being temperature and precipitation. Local climatic factors are effective in determining the range and development of individual species and associations and, in forest stands, more particularly of young trees. The usual natural succession following invasion of open land is from the more hardy trees, such as Hawthorn, Scots Pine, Aspen and Birch, to the less hardy climax species, such as Oak and Beech, which become established in relatively favourable conditions of climate and soil provided by the woodland of hardy species.

Locality and other factors which affect degree of frost injury are discussed. A list of exotic and indigenous forest tree species is included showing their relative susceptibility to frost damage. Overhead and side shelter afforded by high forest and coppicewood is effective in moderating low temperatures of the air near the ground surface.

42.34 : 38.5 : 11.62.12. Meginnis, H. G. **The pole-frame brush dam: a low-cost mechanical aid in reforesting gullied land.** U.S.D.A. Forest Service. *Southern Forest Exp. Sta. Occ. Pap.* No. 76. 1938. pp. 8.

An inexpensive, dependable structure designed primarily to collect and build up deposits of good soils in eroded gullies preliminary to the establishment of vegetation. An upright anchor pole is set in mid-channel to a depth of 24 to 36 in. and to a height of about 18 in. A framework of poles is built with the downstream ends overlapped at the anchor post and the upstream ends held firmly into the gully bank. The frame is back-filled with boughs—preferably Pine tops and Cedar. This type of dam can be built in little over an hour.

43. FOREST FIRES

43 (77.1). Leete, B. E. **Forest fires in Ohio, 1923 to 1935.** *Bull. Ohio agric. Exp. Sta.* 598. Ohio Agricultural Experiment Station, Wooster, Ohio. 1938. pp. 54.

43.1. Spaulding, P., Hansborough, J. K., and Westveld, M. **Fire danger on Red Spruce slashings in northern New Hampshire as influenced by age and condition of slash.** *Northeastern Forest Exp. Sta. Tech. Note* No. 28. 1939. pp. 4.

Fire danger from slash areas, apart from environmental conditions, at elevations below 2,750 ft. varies with changes in volume and condition of slash over periods of years following cutting. After 5 years the amount of slash remains unchanged and the danger is extreme, after 13 to 14 years 75 per cent. of the original slash remains and the danger is high, after 17 years 50 per cent. of original slash remains and the danger is medium, after 19 years the danger is low, and after 26 to 29 years 25 per cent. of original slash remains and conditions are safe.

43.1. Beall, H. W. **Measuring the fire-hazard in prairie forests.** *For. Chron.* 15, 1939 (113–18). [Dominion Forest Service, Ottawa.]

Forest weather records, from three stations in the Prairie Provinces, taken at the time fires started in the vicinity of the stations (average distance of 22·6 miles), were applied to the Wright Fire-hazard Tables and the hazard index was computed. The fast-drying Red and White Pine index has been found to have wide application and was used in this case. A definite correlation was established between the index and (1) the relative frequency of fires per day, (2) the relative area burned per fire. All the relevant data to be used with the Wright Fire-hazard Tables may be obtained with a rain-gauge, an evaporimeter, and a wet-and-dry bulb hygrometer.

43.1 : 07.7 (73). Rice, G. A. **Fire-fighting with water: a manual on water and portable pumper equipment.** Fire Fighting Equipment Division, Pacific Marine Supply Company, Seattle, Washington. 1939. pp. 72.

43.1 : 07.7 (78). Brown, A. A., and Davis, W. S. **A fire danger meter for the Rocky Mountain Region.** *J. For.* 37, 1939 (552–8). [U.S. Forest Service.]

The specifications for a new fire danger meter have been developed to answer the requirements for this particular region. They are based on the analysis of the ratings of meters

already in use in other regions, for data on 312 Class C fires reported throughout the Rocky Mountain Region since 1920. The ratings for the new meter were confined to burning conditions which are related mainly to weather. The factors found most useful for rating burning conditions are wind velocity, air temperature, fuel moisture plus ¼ relative humidity, and interval in days since last rain. For purposes of analysis the range of readings for each factor is divided into five classes of effectiveness, the classes for each factor being given a scale of percentage values that is weighted according to the relative influence of the particular factor on fire hazard conditions in that region. The percentage values for all factors on any one day are added together to give the class of fire danger for that day. A 10 per cent. subtraction is made from the total reading when grass and annual vegetation is in growth, and a 5 per cent. subtraction is made when it is curing.

43.1 : 23.13 : 12.25.53 (79.6). DAVIS, K. P., and KLEHM, K. A. **Controlled burning in the Western White Pine type.** *J. For.* 37, 1939 (399–407). [N. Rocky Mt. Forest and Range Exp. Sta., Montana.]

Controlled burning has been employed to some extent in the Western White Pine type, particularly in northern Idaho, to reduce excessive fuel volumes in timber stands accidentally killed by fire, and to dispose of large quantities of defective and unmerchantable timber. The development of these methods for controlled burning is discussed with particular reference to selection of area, preparation of site and fuel, the best season, weather conditions and time of day for burning, the technique for starting and controlling fires and the necessary equipment. Some consideration is given to methods and time of regeneration after burning. While much of the work has been done by emergency labour, an attempt is made to give a brief analysis of the cost of burning.

43.1 (941). O'DONNELL, J. **Forest-fire control in Western Australia.** *Aust. For.* 4, 1939 (15–21).

Extensive controlled burning of firebreak belts and dangerous hazards is carried out annually during the spring and autumn. Eighteen towers, four tree look-outs, and a number of houses on vantage points in the forest provide facilities for accurate detection; the main routes of access embrace 2,260 miles of forest roads and 5,780 miles of firelines; 1,030 miles of departmental telephone line and 490 telephones are used for communication, while twenty-four departmetal motor trucks are equipped with water supplies and fire-fighting implements and are constantly available for transport during the summer months. Trained volunteer settlers and timber workers give valuable assistance. Annual fire losses during the last few years have been confined to less than 0·03 per cent. of the area protected. *From author's summary.*

43.1 (945). AUSTRALIA. **Report of the Royal Commission to inquire into the causes of and measures taken to prevent the bush fires of January, 1939, and to protect life and property, and the measures to be taken to prevent bush fires in Victoria and to protect life and property in the event of future bush fires.** Acting Govt. Printer, Melbourne. 1939. pp. 36.

43.1 (948). PRYOR, L. D. **The bush fire problem in the Australian Capital Territory.** *Aust. For.* 4, 1939 (33–8).

A discussion of the factors such as climate, topography, vegetation, and human action that affect the problem of forest fire, and of the effect of fire on the vegetation in this particular region. Although the ability of most Eucalypts to resist fire tends to delay the rate of destruction and to mask the effect of fire on the site, nevertheless floristic composition is being continually changed by this agent in favour of inferior species, the average size of the trees is being reduced, and the undergrowth is maintained in a dense, inflammable condition. It is estimated that 75 per cent. of the fires are the result of accident or carelessness and 20 per cent. are deliberate.

43.13.1 (73). CAMPBELL, J. F. **Servicing fire crews by airplane.** *J. For.* 37, 1939 (531–8). [U.S. Forest Service.]

The use of the aeroplane in transporting supplies to fire-fighting crews in inaccessible areas and where time is an important factor. A discussion of the possibilities and limitations of this service and the requirements for greatest efficiency with reference to the most suitable type of machine, cheap parachutes for retarding the speed of dropped parcels, and the necessary equipment and organization.

43.2 (74). SHEPARD, H. B. **Forest fire insurance in the Northeastern States.** *Tech. Bull.*

U.S. Dep. Agric. No. 651. Supt. of Documents, Washington, D.C. 1939. pp. 46.

A field investigation to determine the fire damage and effect of fire on forests of different types and ages, as well as to evaluate fire-hazard factors in the Northern forest, north-eastern White Pine, north-eastern Oak, and Allegheny hardwood forest regions. The field work was supplemented by a study of the individual fire reports of local wardens and rangers. As a result of the study it was possible to determine the value of the forest destroyed in each type, the causal and contributive hazard factors of the area and their relative importance, and the natural forest condition that had the least possible fire hazard. A rating schedule was drawn up based on a statistically determined normal loss expectation for the whole area and for each region.

43.3 (945). **Bush fires in Victoria.** *Nature, Lond.* 144, 1939 (97–100).

The estimated loss of timber in easily accessible areas is 2,070,000,000 superficial feet of which 916,000,000 superficial feet can be salvaged. Most of this forest was composed of Gum trees of the Ash group, such as *Eucalyptus regnans* and *E. gigantea*, which will not recover from intense burning. In the past very good natural regeneration has followed fire and this may happen again.

43.3 (945). GALBRAITH, A. V. **The disastrous forest fires of January 1939, in Victoria.** *Emp. For. J.* 18, 1939 (10–18).

A discussion of meteorological data and other causal and contributive factors, the total amount and type of damage done, measures proposed for the felling, transport, preservation, milling, and marketing of salvage wood, and various problems in regard to the regeneration of the burnt areas.

44. PROTECTION AGAINST DAMAGE BY HARMFUL PLANTS

44.3 : 23.26.7. MARTIN, T. F. **A cure for damping-off.** *Horticulture* 17, 1939 (282).

A solution of 1 ounce of copper carbonate ($CuCO_3$) dust in 6 quarts of water. *Plant Science Literature* 9, No. 25.

44.3 : 12.21 : 47. MARCHAL, E., and MAYNÉ, R. **The present position of research on Elm disease: report of the Commission Spéciale du Conseil Supérieur des Forêts.** *Bull. Soc. for. Belg.* 46, 1939 (193–202). [F.]

44.3 : 12.21 : 12.26.22. DAY, W. R. **Root-rot of Sweet Chestnut and Beech caused by species of *Phytophthora*: I. Cause and symptoms of disease: its relation to soil conditions.** *Forestry* 12, 1938 (101–16). **II. Inoculation experiments and methods of control.** *Forestry* 13, 1939 (46–58).

This paper is concerned with root rot of *Castanea sativa* and *Fagus sylvatica* caused by *Phytophthora cambivora*, *Ph. syringae*, and *Ph. cinnamoni*. The host range of these fungi is indicated and the course of development and general symptoms of disease described. Each of the parasites causes a disease of exactly similar appearance. *Phytophthora* root rot is shown to be associated with moist water-retentive soils and to be especially serious when the depth of well-drained soil is shallow and the drainage in the subsoil impeded. Inoculation experiments indicate that *Castanea sativa*, *C. crenata*, and *Fagus sylvatica*, are all susceptible to all three species of parasite in varying degrees. Plants of *C. crenata* that have been raised in this country have proved to be susceptible to frost. The various methods of controlling the disease are discussed. The use of resistant sorts of Chestnuts is the most important method used abroad. The cultivation of the Chestnut under soil conditions that favour the development of the infection should be avoided. *From author's summary.*

44.3 : 12.25.55. HEPTING, G. H., and TOOLE, E. R. **The Hemlock rust caused by *Melampsora farlowii*.** *Phytopathology* 29, 1939 (463–72).

This rust attacks twigs, leaves, and cones. It is widely distributed in the eastern United States and Canada, causing severe damage only under conditions of dense Hemlock shade. Carolina Hemlock is much more resistant than eastern Hemlock. The most efficient control was obtained by spraying with lime-sulphur (4 lb. of the dry form to 50 gal. of water) weekly through May. *From author's summary.*

44.3 : 12.21.8 (489). JØRGENSEN, C. A., LUND, A., and TRESCHOW, C. Undersøgelser over rodfordærveren, *Fomes annosus* (Fr.) Cke. **[Studies on the heart-rot fungus *Fomes annosus* (Fr.) Cke.]** *K. VetHøjsk. Aarsskr.* 1939 (71–129). [Da.e.] A.P.B.

The regional distribution of the fungus in

Denmark is outlined. Among the conifers grown in that country, Sitka Spruce is the most susceptible to the fungus, Silver Fir is the most resistant, and, from an economic viewpoint, the damage is most serious in Norway Spruce, which is the main coniferous species in the Danish forests. The fungus appears to be more destructive in Spruce plantations growing on sandy soils than in those on clay, probably because many sandy sites were formerly arable land. When Norway Spruce is cultivated in the same locality for two or more generations, the attack usually becomes increasingly severe. Excavations of naturally infected trees, and infection experiments, give evidence that dead roots attached to the basal part of the trunk must be the main source of infection. Sowing rather than planting is advocated as a preventive measure. Where planting is practised, however, the roots of the plants should be spread flat in the uppermost layer of soil to prevent the development of tap roots, which usually die in the early stages of growth. Other preventive measures are the planting in mixture with broad-leaved species, and thinning heavily from the age of 20–25 at intervals of 2–3 years. Pure culture experiments with various media are also reported on.

43.3 : 12.26.53 (73). TRUE, R. P., and SLOWATA, S. S. **Scouting and sampling Elms with symptoms commonly associated with the Dutch Elm Disease as an aid in eradicating *Ceratostomella ulmi*.** *Phytopathology* 29, 1939 (529–37). [Division of Forest Pathology, U.S.A.]

Observations made every 2 weeks on 2,239 trees during 1936 and 4,424 trees during 1937 indicated that as the summer season advanced the number of Elms showing external symptoms commonly associated with the Dutch Elm disease increased markedly until the middle of September, when defoliation set in. Only a small percentage of the trees observed was actually infected with *Ceratostomella ulmi*. The efficiency of symptom sampling was at its maximum during the latter part of June and throughout July. *From author's summary.*

44.3 : 24 (73). CAMPBELL, W. A. **Preliminary report on decay in Sprout Northern Hardwoods in relation to timber stand improvement.** Northeastern Forest Exp. Sta. *Occ. Pap.* No. 6. 1938. pp. 8.

44.3 : 24 (77). LORENZ, R. C., and CHRISTENSEN, C. M. **A survey of forest tree diseases and their relation to stand improvement in the Lake and Central States.** U.S. Department of Agriculture, Bureau of Plant Industry. 1937. pp. 52. P.R.

45. PROTECTION AGAINST DAMAGE BY ANIMALS

45.3. FISHER, R. C. **Tree injection and insect attack.** *Emp. For. J.* 18, 1939 (125–8).

A review of papers on this subject and an indication of the trend of the results so far obtained. It appears that further investigation is essential before any final conclusions can be drawn.

45.3 : 13.21.85.53.42. CLAUSEN, R. **Results of some experiments on the control of *Dreyfusia nüsslini* C.B. [*nordmannianae* Eckst.].** *Schweiz. Z. Forstw.* 90, 1939 (209–23). [G.g.]

Experiments led to the preparation of 'Derux T.' which is more suitable for the treatment of young trees than 'Carbofort' and other sprays hitherto employed.

45.3 : 13.21.85.54 (43). TEMPEL, W. Ein Massenauftreten von Asopinen [*Hemiptera: Pentatomidae*]. [**A mass occurrence of *Asopinae*.**] *Arb. physiol. angew. Ent. Berl.* 6, 1939. (51–6). R.A.E. A 27 (354).

Pentatomid nymphs, mainly those of *Pinthaeus sanguinipes* F., were found in a forest district in Hesse where Beech, Oak, and Pine were being defoliated by *Lymantria* (*Porthesia*) *dispar* L. They preyed on larvae of *L. dispar*, *Aglia tau* L., *Dasychira pudibunda* L., Noctuids, and young larvae of *Calosoma*. In the laboratory they readily attacked these larvae and also those of *Leptinotarsa decemlineata* Say, *Vanessa io* L., Geometrids, sawflies, and their own species. Adults of *Troilus luridus* F., also taken in the forest, fed on all the insects offered to them. The distribution of *P. sanguinipes* and *T. luridus* is given, and it is considered that these and related species can be valuable in reducing insect outbreaks.

45.3 : 13.21.85.63.31 (43). THIEM, H. Zur Lage und Gestaltung der Maikäferbekämpfung. [**The position and future of may-beetle control.**] *Int. Congr. Ent.* 7 [2]. Preprint. Berlin 1938. pp. 20. R.A.E. A 27 (299–300).

Includes an account of experiments on the

effectiveness against adult beetles of proprietary insectides containing dinitro-o-cresol. In June 1938 mixed forests were treated by aeroplane with a dust containing 10 per cent. dinitro-o-cresol applied at the rate of 36 lb. per acre in moderately warm weather. Mortality on the following day was 93·5 per cent. In another district a dust of equal strength was applied by power dusters at the rate of 72–90 lb. per acre and gave good control. Power dusting is preferable for small discontinuous areas. Sprays with solutions of dinitro-o-cresol at a concentration of 0·3 per cent. also gave considerable mortality. Spraying is considered preferable to dusting for trees in streets, avenues, parks, and hedges. Dusting or spraying with dinitro-o-cresol is unsuitable in orchards, owing to the injury to the leaves, but beetles shaken from the trees may be killed in a solution of it.

45.3 : 13.21.85.63.31 (43). PUSTER, R. **Old and new methods of cockchafer control in the production forest.** *Forstwiss. Cbl.* 61, 1939 (493–505). [G.]

45.3 : 13.21.85.71 : 12.26.22 : 13.11 (43). BARNES, H. F. **A new gall-midge attacking Beech buds.** *Arb. physiol. angew. Ent. Berl.* 6, 1939 (41–3).

FISCHER, H. Zur Biologie und Bekämpfung von Knospen-Gallmücken an Rotbuchen [**The biology and control of bud gall-midges on Beech**]. *L.c.* (44–5). R.A.E. A 27 (353).

The first paper describes the larva and the adults of both sexes of *Dasyneura fagicola* n.sp. the larvae of which were taken in association with those of *Contarinia fagi* Rübs. in Schleswig-Holstein. The second deals with the biology and control of both species. The gall-midges go through several generations in a year, autumn pupae hibernating in the ground. Larvae of the July adults seem to do the most damage. Injury to the trees consists in withering or deformation of the buds. As a control, tobacco dust should be applied in the last week of May, followed by two applications of an 0·1 per cent. spray of nicotine during the first week of June. Further sprayings should be made between the 5th and 10th of July and the 10th and 20th of August. This also controls *Phyllaphis fagi* L. New plantations of Beech should be laid out as far as possible from infested trees.

45.3 : 13.21.85.82.1 (43.1). STAHL, G. **The control of the Pine looper moth in Prussia during 1937.** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (127–34). [G.]

45.3 : 13.15 : 13.21.85.91.1 (43.11). BITTER, B., and NIKLAS, O. F. **The mass reproduction of the Pine sawfly, *Pteronus* [*Lophyrus*] *pini* L., in the forest district of Trappen [Trappönen], East Prussia, 1936–37.** *Forstwiss. Cbl.* 61, 1939 (429–47). [G.g.]

Report on population studies and control. The results obtained with 'Effusan' contact poison applied at a rate of 60 kilograms per hectare were very satisfactory.

45.3 : 13.21.85.91.1 (43.8). HARDY, J. E. **Natural control of *Diprion similis* Htg. in Poland during 1936.** *Bull. ent. Res.* 30, 1939 (237–46).

An attempt was made to determine the relative value of predators, pathogenic organisms, and parasites in the natural control of the sawfly in Poland in 1936–7, both separately and where the control by these factors overlap. The pathogenic organisms believed to be both bacteria and saprophytic fungi proved the most effective control factor.

45.3 : 13.21.85.8 : 12.26.22 (43.8). GIEYSZTOR, M., and PAWŁOWICZ, J. Beobachtungen über das Massenauftreten von *Erannis*- und *Operophtera*-Arten [*Lep.*] in einem Eichenwalde der Oberförsterei Rogów [Polen]. [**Observations on the mass occurrence of species of *Erannis* and *Operophtera* [Lep.] in an Oak forest in Rogow [Poland].**] *Bull. ent. Pologne* 16–17, 1939 (16–36). [G.] R.A.E. A 27 (438).

An unusual outbreak of *Erannis aurantiaria* Hb. and *E. defoliaria* Cl. occurred in 1935 and 1936 on Oaks in a mixed forest consisting chiefly of Oak trees 150–170 years old. *E. aurantiaria* represented 52 per cent. and *E. defoliaria* 41 per cent. of all the Lepidoptera present on the Oaks; the others included *Operophtera brumata* L. Young trees and some of the old ones were completely defoliated, and the larvae also attacked *Corylus avellana*, *Sorbus aucuparia*, and especially *Vaccinium myrtillus*. In 1936 an area of 75 acres severely infested with *Erannis* and *O. brumata* was sprayed between the 15th and 21st of May with Paris green (2·8 lb. per 100 gals. water with the addition of milk of lime). The spray was applied with knapsack sprayers and was very effective, especially on the lower foliage, on which practically all the larvae were killed. The outbreak

did not recur in 1937. Notes are given on predators and parasites of the moths.

45.3 : 13.15 (67.6). KNIGHT, C. D. **Observations on the life-history and control of white borer of Coffee in Kenya.** *E. Afr. agric. J.* 5, 1939 (61–7).

45.3 : 13.21.85.67.2 (69.1). GARTHWAITE, P. F. **On the biology of *Calopepla leayana* Latr. [Chrysomelidae, Col.] and the possibilities of control.** *Indian For. Rec.* [*n.s.*] *Entomology* 5, 1939 (237–77). Manager of Publications, Delhi.

Calopepla leayana Latr. (Chrysomelidae), feeding on the leaves of *Gmelina arborea*, was a main factor responsible for the abandonment of 2,080 acres of plantations of this species at Namtu in the Northern Shan States, Burma. The beetle goes through two generations and a partial third generation in the year, hibernating as an adult from September to November until May. The egg, larval, pupal, and adult stages are described and illustrated in 15 figures in two coloured plates. *Brachymeria* sp. (Chalcididae) is a common pupal parasite and *Tetrastichus* sp. (Eulophidae) an egg parasite, the life-histories of which are discussed. Mechanical methods of control, hand-picking, and trapping, were ineffective in checking the beetle at Namtu. Various other methods for the testing of which there were no opportunities at Namtu, are discussed. Failing the establishment of an introduced exotic parasite, co-ordinated control measures would have to be carried out annually.

References are made to records of the insect in India from data supplied by the Forest Research Institute, Dehra Dun. *Author's summary.*

45.3 : 22 : 24 (73.4). BEHRE, C. E. **The opportunity for forestry practice in the control of gypsy moth in Massachusetts woodlands.** *J. For.* 37, 1939 (546–51). [Northeastern Forest Exp. Sta., New Haven.]

The eradication of the gypsy moth from New England is recognized as being impossible. Factors of outstanding importance in controlling the insect and preventing its spread beyond this region are the marked preference of the larvae for the foliage of certain tree species, notably Grey Birch, Basswood, Alder, all species of Poplar and Oak, and the possibility of changing and rebuilding stand composition through silvicultural treatment. Forest surveys that have been made throughout most of the State of Massachusetts record the species composition of the forests and so indicate the present natural resistance or susceptibility to the moth, and the possibility for improving natural conditions in this respect. The data are separated into five classes of stand composition based on the percentage of resistant or favoured species present. In the northern hardwood region, in the western part of the State, 75 per cent. of the plots were found to be completely or dominantly resistant, whereas in the Pine-Oak region to the east only about 40 per cent. of the plots were in this category. Recommendations are included for future work on the problem in Massachusetts.

5. INCREMENT. YIELD

51. INSTRUMENTS

51 : 52.2. HETZEL, J. E. **An extension rod for measuring tree heights.** *J. For.* 37, 1939 (494–5).

Made of wood and consisting of four 8-ft. sliding sections held by clamps.

51 : 52.22. HESS, R. **A pocket Biltmore stick.** *J. For.* 37, 1939 (579–80).

As made from a concave-formed steel rule.

52. MEASUREMENT OF TIMBER VOLUME

52.1. ZIEGER. **Investigations on the expenditure of work in callipering.** *Tharandt. orstl. Jb.* 90, 1939 (272–93). [G.]

The work required in callipering more or less pure Spruce stands in flat country as affected by weather conditions, the hour of the day, the ability of the column leader, the number of men employed in callipering, and the density of stocking. It was found that the writing agility of the column leader was an important factor and that the employment of 3 instead of 2 men on callipering in stands of under 1,200 and over 2,600 stems per ha. increased the efficiency of the column, in terms of number of stems callipered per hour, by 30 and 20 per cent., respectively. The optimum stocking density for callipering corresponded to 1,700–2,300 stems per ha. A table is given from which the performance, in number of stems per hour, of columns of 3 and 4 men (column leader and

2 or 3 men doing the callipering), respectively, can be estimated if the approximate stocking density is known.

52.43. HOHENADL, W. **Introduction to the method of determining the volume, increment, value, and value increment of stands by the use of two mean trees.** *Forstwiss. Cbl.* 61, 1939 (261–80). [G.]

The volume of a stand is obtained from $V = N\frac{V_1+V_2}{2}$, where N = total number of stems and V_1 and V_2 the volumes of the 'thin' and the 'thick' mean trees. These volumes are expressed by $V_1 = d_1 \times h_1 \times f_1$ and $V_2 = d_2 \times h_2 \times f_2$, where $d_1 = a - \sigma$ and $d_2 = a + \sigma$, a being the mean diameter of the stand and σ the standard deviation of a. The heights h_1 and h_2 are obtained from a diameter/height curve and the form factors f_1, and f_2 from volume tables. This method of interpreting crop data is claimed to save calculation without sacrificing precision. Such mean trees may also be used for the calculation of form factors, for estimating the value of the stand and the study of its volume and value increment.

52.43 (485). HAGBERG, N. Femton standardserier för ståndskogskubering. **[Fifteen 'standard series' for estimating the volume of standing timber.]** *Skogen* 26, 1939 (330–3). [Sw.]

The 15 'standard series', which have been constructed from data collected during the State Forest Valuation Survey, are designed for use in even-aged mixed Pine–Spruce–Birch stands in central Sweden. For determining the appropriate 'standard series' to be used, the necessary factors are species, site quality class, and approximate age: when these factors are known, the number of the appropriate series can be found in a key table with separate columns for individual stands, 20-year age classes, and whole woods. Two supplementary graphs are provided to aid in determining the appropriate 'standard series'. Once the series number is known the volume of the trees can be read off directly against D.B.H. in a second table. A percentage correction may have to be made for stock density. The method is reasonably exact, its accuracy increasing with the size of the area measured: it represents a compromise between crude tables, in which volume is obtained from the D.B.H. alone, and precise sample-tree methods, which are too costly and laborious for many practical purposes.

52.43.3 : 12.25.52 (489). SABROE, A. S. **Form and form factor in Norway Spruce.** *Forstl. Forsøgsv. Danm.* 14, 1939 (281–428). [Da.g.]

Tor Jonson's methods applied to Danish Spruce. The results are tabulated and discussed.

52.43.32 : 12.25.5. FRITZ, E. **Volume table for old-growth Redwood.** *Timberman* 40, 1939 (38 and 40).

54. SORTING AND FACTORS INFLUENCING ASSORTMENT

54 : 32.3 : 12.26.22 (43). VOGEL, K. **A sorting table for Oak.** *Allg. Forst.—u. Jagdztg.* 1939 (205–16). [G.]

The table gives an estimate of the volumes of the various 'sortiments' (size groups) as recognized in Germany; these volumes can be obtained from individual trees or whole stands. The construction and application of the table are explained and discussed.

55. AGE

55.3 : 56 : 12.25.52 (481). SKINNEMOEN, K. Studier over alder og tilvekst procent i granskoger på Østlandet. **[Studies on age and increment per cent. in the Spruce forests of Østland.]** *Medd. norske Skogforsøksv.* No. 23 [Vol. 6, No. 4]. 1939 (533–659). [Nor.nor.g.]

In the Spruce forests of eastern Norway the correlation between age and diameter at breast height is either low or quite uncertain. This is attributed to the primitive selection fellings practised until recently, and partly also to poor site quality. On the other hand, age is distinctly correlated with the sectional area (at breast height) increment per cent. as determined by the formulae of Jonson and of Schneider.

56. INCREMENT

56–7 (485). HAGBERG, N. Hur går höjdkurvan? En jämförande översikt över trädens, beståndens, och skogarnas höjdkurvor. **[The form of the height curve: a comparative review of the height curves of individual trees, stands, and forests.]** *Skogen* 26, 1939 (288–92). [Sw.]

Typical examples are given of height curves for trees, stands, and whole woods in central Swedish mixed coniferous forest of a pre-

dominantly even-aged and well-stocked character. The curves fall into various types according as they relate to single trees, stands, or whole woods, to Pine or Spruce, to thinnings or the residual stand, to height as plotted against diameter or age, &c. Within the types there is further variation with age of stand, site quality, stock density, &c. These points should be considered in the construction and use of height curves, and an effort should be made to keep together material of the same type, e.g. curves for whole woods should not be applied to individual stands, and so forth.

56.13 : 07.7. Fritz, E. **Increment core handling.** *J. For.* 37, 1939 (491–2).

A wooden 'book' for holding increment cores is described. It is suggested that a slight 'burn' from a rapidly rotating disk sander will increase the contrast between springwood and summerwood.

56.13.1. Turberville, H. W., and Hough, A. F. **Errors in age counts of suppressed trees.** *J. For.* 37, 1939 (417–18).

The inability of badly suppressed trees to manufacture their normal food requirements may often prevent the addition of annual rings to certain parts of the bole.

56.14 : 51 (94). Jacobs, M. R. **An instrument for measuring the height increment of Pines.** *Leafl. Aust. For. Bur.* No. 51. Commonwealth Govt. Printer, Canberra. 1939. pp. 9.

In its simplest form this instrument is a long, graduated rod fitted with a bolt at right angles through one end. The observer sights along the rod, aligning the tree height increment (internode) to be measured and the upright bolt, and adjusting the length of the pole in front of the eye until the tree increment is observed between two points of known distance on the bolt. This known distance divided by the length of rod between the eye and the bolt gives the tangent of the angle (i) from the eye to the tree increment. The value of the increment is determined from the formula

$$BC\left(\tan h - \frac{\tan h - \tan i}{1 + \tan h \tan i}\right)$$

in which BC is the distance from the observer to the foot of the tree and the angle h is that of elevation from the observer to the tip of the growth stage to be measured, and is obtained by an Abney level or similar instrument. Tables are used which give tan i as a decimal and which give values for that part of the formula in brackets, for different values of h and i.

By this method any error in estimation of the increment is proportional to the increment itself and not to the height of the tree. Experience shows it to be a quick and accurate method though it cannot be used with trees having rounded crowns.

56.21.3 : 07.7. Recknagel, A. B. **Simplified growth determination with increment borer.** *J. For.* 37, 1939 (582–3).

57. PROGRESSIVE DEVELOPMENT OF STANDS. YIELD

57.11 : 57.9 : 12.25.52 (485). Hagberg, N. Nyare produktionsundersökningar i granbestånd. [**Recent investigations on yield in stands of Norway Spruce.**] *Svenska Skogsv-Fören. Tidskr.* 37, 1939 (327–38). [Sw.]

Recent yield tables for Spruce are discussed. It is concluded that, in the absence of good Swedish yield tables, C. M. Møller's tables for Danish Spruce plantations should approximate closely to conditions in southern and western Gothland, while for central and south-central Sweden some modification in the direction of Wiedemann's German tables might prove useful.

57.21 : 12.26.22 (44). Perrin, H. **On the increment of Oaks in coppice-with-standards.** *Rev. Eaux For.* 77, 1939 (293–305). [F.f.]

The girth, stem volume, and value increments of Oak standards were investigated with special reference to veterans (*anciens*). The investigations were conducted in the Saône basin and included forests comparable in all respects except soil quality. The data, based on the comparison of successive enumerations, showed that the production of veterans can be profitable, provided the soil is fertile and a careful selection is practised.

57.9 : 12.25.52 (77.6). Fox, G. D., and Kruse, G. W. **A yield table for well-stocked stands of Black Spruce [*Picea mariana*] in north-eastern Minnesota.** *J. For.* 37, 1939 (565–7). [Superior National Forest, Minnesota.]

The data are separated into three crown classes—dominant and co-dominant, intermediate, and suppressed; and three site classes —good, medium, and poor.

6 (71.3). CROSBIE, H. W. **Consideration of forest management possibilities in the Trent district of Ontario.** *For. Chron.* 15, 1939 (78–80). [Ontario Forest Service, Toronto.]

Since cutting operations started in this region in the middle of the last century, repeated logging and burning have resulted in a complex vegetation quite different from the virgin forest, which was largely Pine, Hemlock, and tolerant hardwoods in varying proportions. Soil quality has also been adversely affected. The present forest vegetation in the eastern part of the area is classified by percentage of forest types and age classes. Consideration is given to the management of the principal types on the basis of modification of logging practice, particularly in the application of diameter control, the cutting of pulpwood, and the possible development of fuelwood operations for improving hardwood stands.

6 (71.3). BEDELL, G. **Forest management on the Duck Mountain Forest Reserve.** *For. Chron.* 15, 1939 (81–4). [Manitoba Forest Service, Winnipeg.]

An outline of the management plan for an area of approximately 1,300 square miles in Western Manitoba. The cutting is controlled on a basis of sustained yield, the present annual cut being limited to one-half the total annual increment. Black and White Spruce are the principal commercial species of this area as the Jack Pine is largely of young age classes and there is little demand for Balsam Fir and hardwoods. Local wood requirements receive first consideration when cutting permits are issued.

6 : 94.3 (77–8). MARTIN, C. S. **What woods practices are necessary for the development of private forestry?** With comments by T. D. Woodbury. *J. For.* 37, 1939 (465–70).

With particular reference to the difficulties of applying sustained yield management to the forests of the north-western United States.

61. SURVEYING. MAPPING

61.3. WILCOX, F. R. **Possibilities of stratosphere and sub-stratosphere photography in the administration of forest lands.** *J. For.* 37, 1939 (441–4).

The value of aerial photographs—and more particularly vertical photographs—in forest management is summarized under the headings: maps, timber typing, operating data, and volumetric data. A preliminary type map based on the not too intensive compilation of photographs is of particular value for inventory or valuation surveys and planning timber cruises. The use of the stereoscope, and the possible use of stereograms, for interpreting aerial photographs, is emphasized. The cost of aerial photographs varies directly with the scale of the photographs. Two possibilities for obtaining small-scale pictures are considered—the taking of stratosphere or sub-stratosphere photographs, and alternatively the use of a short focal length lens. The author favours the first of these owing to the recent development of a new stratoplane which will make such photography feasible. These photographs will be of particular value for planimetric maps, timber typing, and inventory, and should be supplemented by large-scale photographs for obtaining operating or volumetric data.

61.3. BURKS, G. F., and WILSON, R. C. **A vegetation inventory from aerial photographs.** *Photogramm. Engng.* 5, 1939 (30–42). [California Forest and Range Exp. Sta.]. L.S.

An experimental study to determine the relative efficiency of aerial photographs and ground methods in mapping vegetation. The steps in preparing a topographic and vegetation type map from vertical photographs are described. The area and certain characteristics of broad vegetational types were easily recognized and outlined from the photographs. The percentage of each class of vegetation in the tree-herb, tree-shrub, and tree-shrub-herb formations was determined with greater accuracy than would be possible from ground mapping. The type boundaries were transferred to the topographic base map which was first prepared from the photographs, and this procedure, in combination with frequent field checking, gave much more detailed and accurate information than could be obtained from the usual field procedure alone. Although the use of aerial photographs eliminates much of the field work, a field analysis is necessary for the final determination of types mapped from the photographs, as it is found inadvisable to map boundaries that cannot be identified from the photographs with accuracy.

It was found that stereoscopic study of the photographs gave additional important information on age classes, type boundaries, and stand densities, and that aerial photographs provide

an accurate guide for the grouping of distinct, homogeneous categories of timber formation.

61.3 : 01.4. NÄSLUND, M. **On computing the standard error in line and sample-plot surveying.** *Medd. Skogsförsöksanst. Stockh.* 31, 1939 (301–44). [Sw.e.]

The frequency distributions of statistics calculated from samples are known only if the samples conform to certain requirements, notably absence of bias. In forest survey work the bias introduced by systematic methods of sampling, as, for example, regularly spaced line surveys, makes the application of these known distributions only approximate. In the methods advocated here these systematic tendencies are measured and allowed for so that more precise standard errors may be calculated.

The author refers to previous work on the subject by himself [1930], Langsaeter [1926, 1927, 1932], Lindeberg [1923, 1926], Östlind [1932], Schumacher and Bull [1930], and Mudgett and Gevorkiantz [1934].

The problem considered is briefly this: from a partial survey it is required to calculate the result of a total survey. It is customary to estimate the standard deviation of a partial survey from the standard deviation of its parts by the usual formula for the standard deviation of a mean $\frac{1}{n}\frac{S[x-\bar{x}]^2}{n-1}$. This formula is, however, derived on the assumption that the partial survey is a random collection of the line sections, a condition which is not strictly fulfilled since once the direction of the lines, the survey percentage, and the position of the first line have been decided upon, the positions of the others are fixed.

If the systematic variation among the parts of a line survey could be separated, the remaining 'accidental' variation would be smaller and would approximate for estimating the variation among all possible line surveys of this same percentage, and thus for estimating the true or total survey. Its appropriateness is more clearly seen if the total survey is considered to be made up of ten 10 per cent. line surveys parallel to the one actually made and that these ten differ from one another not because of systematic variation along or across the lines [since this is the same for all parallel lines across the area], but because of the 'remaining' variation. Thus the appropriate standard deviation for estimating the standard deviation of partial surveys is the standard deviation of the parts bereft of the systematic variation. The procedure of analysis of variance is available for splitting up the observed variation into parts which can severally be ascribed to line, position along line, and random choice of position of first line. This is, in effect, what is recommended. The methods are applied to some actual data and the results show standard errors reduced in the proportion 116 : 100, 112 : 100, and 109 : 100 when this particular kind of systematic variation is removed.

61.3:07.7. GARDNER, I. C. **Relation of camera error to photogrammetric mapping.** *Repr.* from *J. Res. U.S. Bur. Stand.* 22, 1939 (209–38). *Res. Pap. U.S. Bur. Stand.* R.P. 1177. Supt. of Documents, Washington, D.C.

A portion of the errors in a map constructed from aeroplane photographs arises from differences between the actual performance of the aeroplane camera and the postulated performance as defined by the calibration constants. The different sources of errors of this nature are enumerated, and equations are derived showing the relation between errors in the calibration constants of the camera and the resulting errors in the map.

Certain equations give map errors resulting from incorrect value of the calibrated focal length, distortion, and the incorrect location of the principal point. Other sources of error in the camera, such as failure of the film to lie in a plane, the character of performance of the shutter, and imperfect filters are considered, and their effects upon the image evaluated. *From author's summary.*

61.3 : 07.7. COLLETT, M. H. **The slope scale.** *J. For.* 37, 1939 (580–1).

A levelling instrument based on the principle of the carpenter's right angle, consisting of a vertical leg 8·5 ft. long and a horizontal arm 18·5 ft. long, graduated in feet and decimals thereof, and equipped with levelling bubbles.

61.4 (43). HESMER, H., and MEYER, J. **Forest maps as bases for silvicultural planning.** *Forstarchiv* 15, 1939 (287–315). [G.]

Classification and critical analysis of the various types of German forest maps, including historical maps. The authors refer to a land utilization atlas for Niedersachsen (Bodenkundlicher Atlas von Niedersachsen, Herausgegeben vom Oberpräsidenten der Provinz Hannover. Oldenburg 1937), the maps of which indicate

the most suitable tree species in the case of land to be managed under forest. The paper contains a very detailed bibliography of literature and maps.

61.4 : 07.7. ROBINSON, C. S. **Modern equipment and methods in aerial mapping.** *Photogramm. Engng.* 5, 1939 (43–5). L.S.

63. ROTATION

63 : 75 (54). LAURIE, M. V. **The most paying rotation in Indian forestry.** *Indian For.* 65, 1939 (393–403).

HARLOW, C. M. **Financial rotation versus rotation of highest income.** *Indian For.* 65, 1939 (475–81).

HILEY, W. E. **The most paying rotation in Indian forestry.** *Indian For.* 65, 1939 (471–5).

The first of these papers argues in favour of the rotation of maximum net income, as opposed to the classical 'financial rotation', quoting an example in which the annual money yield of the former is 6,200 marks on a rotation of 140 years as against 2,950 marks for the latter on a rotation of 40 years. The second paper takes up the issue on behalf of the financial rotation, pointing out that compound interest is not an invention of the forest theorist, but a fundamental concept of economics, and that the time factor cannot be ignored. For example a plantation 60 years old can be felled now or left to grow to 120 years old when it will fetch three times as much; if sold now, the proceeds would pay for planting up four times the area, and in 60 years time four times as much money would be obtained. Lengthening the rotation beyond that of the financial rotation involves the locking up of capital bearing little or no interest. The third paper also insists on the importance of the time factor and the amount of capital invested. Referring to Laurie's example it is claimed that in practice the reorganization of the forest to produce the highest money yield after 140 years can only be achieved by reducing the revenue for the next 140 years. Whether it is more profitable to forgo part of the revenue for 140 years in order to secure an increased annual revenue after that date cannot be determined without considering capital and compound interest. All three authors agree that in practice other considerations usually justify a longer rotation than is indicated by the theoretical financial rotation.

64. DESCRIPTION OF SITE. ASSESSMENT OF QUALITY

64.6 : 12.25.53. WECK. **On the problem of defining comparable quality classes by means of the characteristics of the crop.** *Tharandt. forstl. Jb.* 90, 1939 (319–94). [G.g.]

Schwappach's Pine tables (1908) are rearranged and modified in such a manner that given the age in 10-year units, the diameter, and the height of trees which by ocular estimate are representative of their stand, the quality class of the latter can be read off to one decimal (e.g. 2·0, 3·7, etc.). The measurement of as few as three well-chosen trees is often sufficient. Trees below the age of 40 and those freed from overhead cover less than 40 years ago must not be used as samples.

65. DESCRIPTION OF GROWING STOCK

65.7 : 12.27.57 (941). STOATE, T. N. **Stem distribution in irregular forests: a study of Jarrah stem distributions in relation to crown ratio.** *Aust. For.* 4, 1939 (23–8).

The investigation of irregular Jarrah (*Eucalyptus marginata*) forests indicates that the various size classes do not occupy equal areas but that relatively large areas are occupied by trees of the middle girth classes of 80 to 120 in. The practical management of virgin Jarrah stands, with the object of maintaining a sustained yield of merchantable trees, requires that large, vigorously growing trees up to 114 in. girth should be retained to put on effective increment.

65.7 : 12.27.57 (941). BEDNALL, B. H. **Crown ratio and Jarrah stocking.** Reply to criticism by H. R. Gray. *Aust. For.* 4, 1939 (46–7).

66. YIELD REGULATION

66 : 22.14 (44). SCHAEFFER, L. **The 'Méthode du contrôle' [yield côntrol based on increment] and the evolution of selection forestry.** *Rev. Eaux For.* 77, 1939 (389–402). [F.f.]

A historical account.

67. WORKING PLANS

67 (43.43). GERMANY. **Extract from the management plan for the Palatinate State forests on land subject to flooding by the Rhine, on the basis of conditions in 1935.** *Mitt. LandesForstverw. Bayerns* 24. Univer-

sitätsbuchdruckerei Dr. C. Wolf & Sohn, Munich. 1939. pp. 153. [G.]

67 (54.2). Coombs, W. F. **Working plan for the Lansdowne Forest Division, 1939–40 to 1953–54.** Supt., Printing and Stationery, Allahabad, U.P., India. 1939. pp. 317.

67 (54.5). Ahmed, M. M. **Working plan for the Daphar Irrigated Plantation, Lahore Forest Division from 1937–38 to 1951–52.** Supt., Govt. Printing, Lahore, Punjab. 1938. pp. 154.

67 (54.8). Kuppuswami, V. S. **A working plan for the forests of Cauvery Range, Salem Central Division, 1930–31 to 1939–40.** Supt., Govt. Press, Madras. 1939. pp. 16.

67 (59.1). Clarke, J. A. **Working plan for the Zigon Forest Division for the period 1933–34 to 1947–48.** Vol. I. Supt., Govt. Printing and Stationery, Rangoon, Burma. 1939. pp. 115.

Clarke, J. A. **Working plan for the Zigon Forest Division for the period 1933–34 to 1947–48.** Vol. II. Supt., Govt. Printing and Stationery, Rangoon, Burma. 1939. pp. 271.

7. ECONOMICS. VALUATION. FINANCE. PROFIT AND LOSS

72.1 : 66 : 12.25.53 (76). Bond, W. E. **Costs and returns of managing 100,000 acres of Shortleaf and Loblolly Pine for sustained yield.** *Southern Forest Exp. Sta. Occ. Pap.* No. 79. U.S.D.A. Forest Service. 1939. pp. 15.

Selection management with a ten-year cutting cycle, mature and defective trees being cut selectively to allow for high-grade and high volume production. The volume cut is regulated by that of the stand and by the growth rate. Stand improvement cuttings depend largely on market conditions. The primary product is sawlogs, and secondary products are pulpwood, fuel wood, ties, &c. All relevant data as to volume, increment, yield, timber value, costs of management and income are summarized in tables.

74 (73). Neff, P. **Valuation of national forest lands.** *J. For.* 37, 1939 (598–600).

A discussion of three court cases in the United States in which the court upheld the decision that the damage to young growth or other forest cover not of commercial or merchantable size or character, on government-owned forest lands, should be determined on the basis of reforestation or replacement cost. Such cost would include artificial regeneration where necessary, protection of the area for a sufficient period to produce a stand similar to that damaged or destroyed, and compound interest on the total amount of expenditure for the same length of time.

74 : 93 (485). Svensson, I. A. Marköverlåtelse vid kraftlednings- och vägbyggen. [**Transference of land for the construction of electric transmission lines and roads.**] *Skogsägaren* 15, 1939 (37–40, 64–8, 122–8). [Sw.]

A method is described of estimating the approximate compensation value of forest land taken over for the construction of electric transmission lines and roads.

9. FOREST POLICY

90. GENERAL PRINCIPLES OF FOREST POLICY

90 : 09.1 (481). Eide, E. Retningslinjer for norsk skogbruk. [**Trends in Norwegian forestry.**] *Svenska SkogsvFören. Tidskr.* 37, 1939 (157–96). [Nor.]

Concern over the future of Norwegian forests and timber supplies led to the establishment of a forest service in the middle of the last century. Most of the foresters of this period were trained in Germany on the ideal of fellings by area, with a regular series of age classes and regular regeneration fellings. Such systems could not be applied in Norway, since the existing forests were extremely irregular and the difficulty of selling small-dimension timber prevented attempts to regularize their composition. Recourse was therefore had to the selective felling of over-mature and damaged trees, in an effort to introduce some order. At the turn of the century, however, there was a radical change of policy: the steady rise of timber prices, the appearance of the first Norwegian-trained foresters, and the publication by U. Wallmo of a book called *Rationell Skogsavverkning*, all turned the tide in favour of selection forestry. The new trend came at a favourable moment

and made it possible to dispose profitably of huge stocks of ripe timber. By 1917 the selection system had become almost universal in Norway and continued so until the last few years, when dissatisfaction became acute. Current opinion is now once more in favour of a well-ordered series of age classes regularly felled by area; it is realized also that measures for regeneration must be taken. Three main factors have contributed to the adoption of the present attitude: (1) The occurrence of economic and technical developments in conversion and communications. In 1900 Norway's annual cut of timber was 6 million cu.m., of which about 60 per cent. went to saw- and planing-mills, only 20 per cent. being used for pulp; whereas in 1934 of the same amount of timber cut 65 per cent. was pulped and only 30 per cent. was used for sawn and planed goods: Norway's pulp exports are now 8 times as valuable as her timber manufactures. Dimension has thus ceased to be the ruling factor in felling, and smaller trees can be utilized with profit; hence a basis is provided for more intensive forms of forestry in which silvicultural operations can be made to pay their way. The revolution of transport by the automobile has also stimulated this industrial development. (2 and 3) The forest survey of 1919–29 together with field research and investigations of timber quality has shown that selection forestry is not suited to Norwegian conditions. As hitherto practised in Norway, the system has been a process of *laissez-aller*, the largest and best trees being removed and regeneration left to chance. The result, as shown by the forest survey, is a general reduction of the timber stock and increment per unit area, and regeneration is very unsatisfactory. Regeneration cannot be left to nature in Norway. Age investigations have proved the existence of a preponderance of suppressed underwood: in one district the average age of the 10 cm. diameter class of Spruce is 58 years, whereas the present 20 cm. class took 39 years and the present 30 cm. class only 26 years to reach the same diameter. Suppressed trees develop inferior timber when released, the dense heart becoming sheathed with loose fast-grown wood; such timber is difficult to work up either into sawn goods or pulp. The released trees are not only badly shaped and branchy, but also hinder the development of regeneration. As a consequence of the recent change in point of view, Norwegian forestry is now in more active development than ever before: forest laws have been adjusted to the times, interest in good silviculture and management for sustained, even yields has been awakened, and foresters are making contacts with industrialists with a view to adapting production to modern needs. The great problem of the future is to bring the forests into good order on a sound productive basis.

90 : 23.2 (481). Opsahl, W. Skogkulturplanen og dens gjennemføring [**The artificial regeneration scheme and its execution**]. *Tidsskr. Skogbr.* 47, 1939 (239–52). [Nor.]

The scheme, suggested by the Director of Forests, and adopted by Parliament, provides for the regeneration (mainly by planting) of 150,000 dekares annually. This is between $\frac{1}{3}$ and $\frac{1}{4}$ of the 'normal' regeneration area, i.e. of 1 per cent. of the total productive forest area. The chief problems to be solved are the allotment of State grants to the various districts, the building up of nursery supplies of seed and seedlings, and the development of instruction and propaganda for forest owners and workers.

90 : 92 : 6(495). Kontos. **New forest policy of Greece.** *Forstwiss. Cbl.* 61, 1939 (447–54). [G.]

The main reforms in the forest policy and administration since 1937 include: (*a*) Total or partial prohibition of grazing, especially of goats, within almost all forest areas. Measures are being taken to compensate the peasants and to help them to reorganize their animal husbandry and their farms in general. (*b*) Afforestation of catchment areas, and river training. Already 35 trained foresters are engaged in this work. (*c*) Afforestation in general. Eighteen million trees are planted annually. (*d*) Intensification of state forest management, including large-scale construction of forest roads, a work in which many peasants participate in their spare time on a purely voluntary basis; creation of modern saw-mills, impregnation plants, &c.; conversion of coppice and coppice-with-standards Oak forests to high forests; and better utilization of minor products such as resin. (*e*) Creation of national parks. (*f*) Reform of forest taxation. (*g*) The encouragement of the idea of co-operative holdings among forest labourers and farmers owning woodland, the peasant co-operative societies also to act as credit societies.

The main object of the new forest policy is to raise the standard of living of the people and to prevent the exodus of the mountain popula-

tion. Already the traditional hostility of these people towards the forests is being overcome.

90 (73). HAMMATT, R. F. **Forest conservation and national security.** *Sci. Mon., N.Y.* 49 (121–34). P.R.

A discussion of the forests, forest policy, and forestry organization of the United States, and the role of forests in the national economy.

91. BENEFICIAL EFFECTS OF THE FOREST

91.11.2 (42). BIRD, P. **National forest parks.** *Emp. For. J.* 18, 1939 (61–4).

Certain areas within the United Kingdom which are reasonably accessible and have the necessary scenic qualities are being developed for the double purpose of timber production and public recreation. The first area of this sort to be set aside is the Argyll National Forest Park of 54,000 acres, representing a great variety of Highland conditions. Two other areas have been approved for this purpose—Snowdonia in North Wales and the Forest of Dean in Gloucestershire.

92. FOREST LAW

92 (66.9). NIGERIA. **Wild Animals Preservation Ordinance [Cap. 99].** Together with amendments and regulations up to 4th August, 1938. Govt. Printer, Lagos. pp. 46.

92 : 98.2 (73). NELLIS, J. C. **Markets for forest growth.** *J. For.* 37, 1939 (653–4).

The Holman-McNary Bill proposes to provide competitive rates and adequate services for the shipping of export lumber and wood products from the United States, either by reducing export rates through subsidies or by leasing or operating vessels for the purpose.

92.1 (56.43). CYPRUS. **A law to amend and consolidate the laws relating to forests in the colony.** Govt. Printer, Nicosia. *Statute Laws of Cyprus* No. 5 of 1939. pp. 14.

94. FOREST OWNERSHIP, ACQUISITION, AND ALIENATION

94.12 (73). REYNOLDS, H. A. **Town Forests: a neglected opportunity.** *J. For.* 37, 1939 (364–7).

94.12 (74.2). HALE, W. F. **Town forests in New Hampshire.** *J. For.* 37, 1939 (525–8).

Notes on the history of some of these forests with reference to the income derived from them and their value in town development.

95. FOREST TAXATION

95.1 (76.2). CRAIG, R. B. **Taxation of forest land in the Yazoo Delta of Mississippi.** *Southern Forest Exp. Sta. Occ. Pap.* No. 74. U.S.D.A. Forest Service. 1938. pp. 43.

97. RELATION OF THE FOREST TO AGRICULTURE, MOUNTAIN PASTURE, AND INDUSTRY

97 : 94.3 (497.2). MINTCHEFF, B. **The economic importance of the private forests of Bulgaria, and measures for improving their management.** *Lesovodska Missal* 7, 1938 (1–18). [Bulg.g.]

Co-operation under legal compulsion is the principal measure advocated with a view to introducing rational management in the private forests of Bulgaria. These cover roughly 508,000 hectares or about 20 per cent. of the total forest area, and consist mainly of small peasant forest holdings.

97.1 (54.87). MCNEILL, W. M. **Land planning in Ceylon with special reference to the selection and reservation of forest areas.** *Emp. For. J.* 18, 1939 (65–76).

In 1929 the Government of Ceylon introduced important changes in the system of land administration embodying the principle of planning in advance the uses to which Crown land should be put. The new system, known locally as 'Mapping-out', involves various steps such as survey, settlement, and planning.

The village is the smallest recognized unit of land, having an average extent of 900 acres, and in general it is on this unit that all planning is based. First the ownership of the land must be carefully investigated and finally designated as either Crown land or private property. Then a plan is developed for all land belonging to the Crown, the plan being based on the objects of land use, which are enumerated in the *Land Development Ordinance* No. 19 of 1935. These include forest reserves, soil conservation, stream protection, and other matters with which the Forest Department is intimately concerned.

97.1 (73). BARRACLOUGH, K. E. **County land use planning.** *J. For.* 37, 1939 (460–1).

A brief description of and comment on the proposed programme of the U.S. Department of Agriculture.

97.2 (73). PRESTON, J. F. **The approach to farm forestry.** *J. For.* 37, 1939 (367–70).

97.2 : 09.7 (76.2). BRUNER, M. H. **Forestry —essential to Delta agriculture.** *J. For.* 37, 1939 (601–4).

An analysis of the problems associated with forestry in the hardwood bottomlands of the Arkansas Delta, with reference to the important place of woodlands in the economy of the farm population.

98. THE STUDY OF THE TIMBER MARKET

98 : 09.4 (44). **The timbers of the French Colonial Empire.** *Rev. int. Bois* 6, 65, 1939 (180–2). [F.]

Data on production and export. Of a total production of 604,277 (metric) tons in 1937, 374,410 tons were exported to foreign countries of which 216,697 tons went to Germany.

98 : 09.4 (44). COLLARDET, J. **Report on the activity of the Comité National des Bois Coloniaux in 1938.** *Act. et C. R. Ass. Colon. Sci.* 15, 1939 (85–95). [F.]

Comments on the export statistics of the main timber-producing French colonies and on market trends in France and abroad during 1938, with notes on the activities of the Committee.

98 : 09.4 (45). SALA, G. **National self-sufficiency in the sphere of wood products.** *Riv. for. ital.* 1, 1939 (21–30, 6–21). [It.]

With reference to Italy.

98 (43 : 497–8). BUCHHOLZ, E. **The importance of the south-eastern European states for the timber supply of Germany.** *Z. Weltforstwirt.* 6, 1939 (523–60). [G.g.e.]

The three important export countries of south-eastern Europe—Bulgaria, Rumania, and Jugoslavia—have between them a forest area about equal to that of Germany (approximately 17 million hectares), while their total population amounts to only 40 millions. Their average annual forest increment is estimated at only 2·5 cu.m. per hectare compared with an average of 4·0 cu.m. in Germany. Most of their exportable surplus is hardwood and up to the present most of the timber exports have gone to Italy, Germany, and Hungary. A pronounced development in the woodworking industries is taking place in these countries.

98.1 : 09.4 (42). WATSON, SIR H. **Imports of timber to the United Kingdom, 1938.** *Emp. For. J.* 18, 1939 (77–82).

98.1 : 8 : 09.4 : 09.1 (494.3). GROSSMANN, H., KREBS, E., RITZLER, K., and WEISZ, L. 600 Jahre Holzversorgung und Forstverwaltung der Stadt Zürich: II. Heft—Holzversorgung und Forstverwaltung im 19. und 20. Jahrhundert. **[Timber supplies and forest administration of Zürich during the past 600 years: Pt. II. Timber supplies and forest administration in the 19th and 20th centuries.]** Stadtforstamt, Zürich, Switzerland. 1938. pp. 153. [G.]

98.2 : 09.4. **World reports and statistics of the timber trade.** *Timb. Statist. Rev.* 1, 1939, No. 1 (1–47, 1–21), No. 2 (1–50, 1–21).

BOOKS

31 : 33.3. TRENDELENBURG, R. Das Holz als Rohstoff: seine Enstehung, stoffliche Beschaffenheit und chemische Verwertung. [**Wood as a raw material: its origin, composition, and value in chemical utilization.**] J. F. Lehrmanns, München and Berlin. 1939. pp. 435.

'Wood as a raw material' has come in recent years to mean much more than 'wood as a constructional material', and its increasing use for such purposes as the production of pulp, cellulose, sugar, charcoal, wood gas, wood wool, and fibre board calls for a better understanding of the nature of the material both on the part of those responsible for efficient production and those concerned with efficient utilization. Dr. Trendelenburg, who is in charge of the department of timber research in the University of München, has furnished a valuable survey of the latest information in a form suitable for scientific forester and technologist. His book opens with a short outline of the distribution, composition, and working of the German forests. This is followed by an account of the development of the stem, in which the elements and tissues and the significance of their variations are discussed. The brief survey of the principal chemical constituents of the cell-wall, and of recent work on the ultramicroscopic structure of the cell-wall, together with references to key papers form a good introduction to a field of rapidly growing importance.

Of particular interest to foresters is the section dealing with the growth of the stem, in which the growth ring is considered as the unit. The various factors known to influence the development and constitution of the growth ring are reviewed in tracing the course of development throughout the year. There is an excellent account of heartwood formation. Density and moisture content are treated comprehensively from a variety of angles, including variation throughout the tree and as influenced by locality and species. Seasonal variations in moisture content are described, and in discussing the influence of moisture content on shrinkage, reference is made to the constitution of the cell-wall.

Das Holz als Rohstoff, which as yet has no English counterpart, is an important addition to the literature of wood. Much of the information given has not yet found its way into other general text-books, and provision is made for readers who wish to pursue the study by references to more than 600 articles of literature. The careful indexing of the book, occupying a section of 45 pages and making access to the contents very simple, is worthy of special mention.

S. H. CLARKE.

13.21.85 : 02.1. GRAHAM, S. A. **Principles of forest entomology.** Edn. 2. McGraw-Hill Publishing Co., Ltd., Aldwych House, London, W.C. 2. 1939. pp. 410.

In the decade which has passed since the first edition of this book a vast amount of new work in forest entomology has appeared, and some idea of the scope of this was seen in the book, *Forest Insects*, by Doane, Van Dyke, Chamberlin, and Burke, published in 1937. The revision of the present work was rendered inevitable in the face of these changes, and the author has incorporated the new results in his pages. He has also rearranged and improved the illustrations, and revised the literature. The general form of the book remains as before, but certain changes and enlargements have been made which have enhanced its value. Thus, chapters 3, 4, and 5, dealing with biotic potential, environmental resistance, and insect abundance, have been recast in part, and form an indispensable introduction to the next four chapters (6–9), which are concerned with the principles of control in all its aspects. These are followed by six chapters in which the various types of insect damage, grouped according to the particular portion of the tree attacked, are dealt with. It is in these chapters that the author has incorporated the results of much new work, notably in the section dealing with the bark beetles (pp. 227–46). Two of the last three chapters deal with insect parasites and predators, while the concluding chapter, an addition to the book, discusses the indirect effects of forest insects, such as their relation to fungus damage, virus disease, &c. In the final paragraphs a short prognosis is given of the future lines along which forest entomology may be expected to develop in the near future, and the author expresses the view that 'The combined efforts of the silviculturist, the forest manager, and the entomologist, will be required to solve the complex ecological problems where forest insects are concerned.'

To enlist the interest of the practical man in the study of forest insects is therefore a primary necessity, and the author has evidently had this in mind when he made the changes in the present edition of his book. The book remains a valuable text-book for the classroom, but also becomes an indispensable handbook for the practical forester.

R. N. CHRYSTAL.

12.19.1 : 09.7(42). TANSLEY, A. G. **The British Islands and their vegetation.** Cambridge University Press. 1939. pp. 968.

The appearance of Professor Tansley's long-awaited book on British vegetation is an event of first-class importance to all interested in the ecology of the British islands. The work, he says, is intended to replace the much smaller *Types of British Vegetation* which was published 28 years ago. The greatly increased size of the present volume is some measure of the progress of ecology in this country, a progress which owes much to the guidance and stimulation of Tansley himself.

The author, who for 21 years edited the *Journal of Ecology*, has had a unique opportunity for maintaining contact with all workers in this field. The present work is largely compilative from published papers; but nevertheless it has unity since it has been welded by one with wide and intimate first-hand knowledge of the British Isles. The presentation of the material is such that it can be read by persons who may be more interested in the broad problems of vegetation, the structure of the communities and their successional relationships, than in the detail of the numerous species lists which are given.

The book is divided into nine parts, of which the first three are introductory and the remainder deal with the major vegetation types.

Part I is an account in 143 pages of the British Isles as an environment of vegetation, the physical features, climate, geology, soils, and the biologic factor, i.e. the influences of man, domestic and wild animals (the other vertebrates and the invertebrates are hardly mentioned). The separation of a 'biologic factor' might, perhaps, not be expected of one who has developed the concept of the 'eco-system', but, in the present state of our knowledge, the author considers that the simplest and most fruitful method is 'to treat the plant community as the primary object of study, and the associated animals as part of the environment'. In Britain the influence of man is not only direct and obvious but also operates through a less obvious, but hardly less important, disturbance of 'the balance of nature'. Evidence of the serious effects resulting from the destruction of the small carnivora, and the consequent increase of mice and voles, is noted in the lack of regeneration of woodland communities.

Part II contains a summary of the history of British vegetation from post-glacial times to the present day. The evidence as to the changes in vegetation and climate in prehistoric Britain, derived from pollen analyses, is summarized, and the effects of changing cultures and systems of land utilization are traced from pre-Roman times to the present. Thus the stage is set for a consideration of the existing plant communities. Most of these are 'semi-natural', i.e. they are composed of native plants, though much moulded by forces other than those of 'nature alone'. Two main types are recognized: communities which began entirely naturally, but which man has much modified; and communities which were initiated by man but which, consisting as they do of native plants, may behave as if they had come into existence naturally. Thus, a planted Oak wood may be difficult to distinguish from a fragment of natural Oak forest if it has been exploited in the same way over a long period of time. Five climatic formation-types are represented in Britain: deciduous summer forest; northern coniferous forest in Scotland (including the birch woods); heath; moss or bog; and arctic-alpine. The grassland, which covers so much of Britain, is not regarded as a climatic climax. It is mostly due to clearing of forest and grazing. Possible exceptions are some of the grasslands at high altitudes on both basic and acidic soils and on exposed cliff-tops. The remaining grasslands are, Tansley holds, biotic climaxes, though some of them, e.g. chalk grassland, may have been held in this state from prehistoric times.

Part III, the shortest of the sections into which the book is divided, is a useful contribution to ecological theory dealing with the nature and classification of vegetation. The dynamic view is adopted and the importance of the concept of the climatic climax recognized, but the author does not limit the use of the term 'climax' to climatic climax alone. A climax community is one which has reached 'a position of relative stability', whether it be primarily determined by the climate or some other factor or combination of factors. This relative equilibrium is the

condition obtaining in 'a mature eco-system', and a mature eco-system dominated by distinctive life forms is, for Tansley, a formation. The association is defined 'in the older European sense of a relatively major plant community dominated not only by distinctive life forms but by distinctive species'. The terms consociation, society, associes, &c., are used in Clements's sense. But a characteristic warning is issued against imagining that the element of rigidity inevitably introduced by the application of such terms to the phenomena of nature is thereby imparted to the phenomena themselves. This warning will be no surprise to those who remember the author's article (*Ecology*, 1935) on 'the use and misuse of vegetational terms and concepts'.

Part IV, the longest in the book, deals with the woodlands and will naturally be of most interest to the forester. Semi-natural as well as natural woodlands are described, but artificial woods, e.g. plantations of exotic conifers, are not considered. General accounts of the Pedunculate Oak and various types of Beech woods only are attempted. The accounts of the other types of woodlands which he recognizes—the Sessile Oak and the mixed Oak woods of sandy soils, the Ash, the Pine and Birch, and the Alder woods—are based on published accounts of particular examples.

The remaining parts of the book treat of the grasslands, the hydroseres (ponds, lakes, rivers, marsh, fen, moss, and bog), heath and moor, mountain vegetation, and maritime communities. A certain amount of cross-reference is necessary. Thus, Alder wood is described in the woodland part, but the earlier stages of the sere, leading up to fen carr, must be sought nearly 200 pages later under fen vegetation

The work ends rather abruptly. The book is, in a sense, insular, but that is implicit in the title. One could have wished for a final section bringing together the pattern of the vegetation as a whole with more reference to the comparable communities on the continent. But Professor Tansley has already given us so much that it is hardly reasonable to ask for more.

The half-tone illustrations are abundant and beautifully produced; many of them are pictures of great artistic merit as well as scientific excellence. They are a remarkable collection of photographs of the British countryside.

In conclusion, a word of congratulation must be offered to the author and the Cambridge University Press upon a beautiful example of printing and book-making. In spite of its size the volume is a pleasure to handle; it has been so bound that the pages remain flat wherever it is opened.

T. G. B. Osborn.

09.4 : 01.4. Paterson, D. D. **Statistical technique in agricultural research: a simple exposition of practice and procedure in biometry.** McGraw-Hill Publishing Company, Ltd., Aldwych House, London, W.C. 2. 1939. pp. 263.

Stoate, T. N., and Lane Poole, C. E. **Application of statistical methods to some Australian forest problems.** *Commonwealth Forestry Bureau Publication*, No. 21. 1938. L. F. Johnston, Commonwealth Government Printer, Canberra. pp. 71.

Rest, J. C. van. **Statistical methods for the forester:** a review. *Emp. For. Jnl.* 18. 1939. [101–5.]

There are few branches of forestry in which the collection and exposition of statistics is not necessary. For example, mensuration is entirely statistical, and in economics, management, and almost any branch of research the collection and examination of statistics is essential at some time or other. It is therefore important and salutary to observe the comparative neglect of the theory and methods of statistics by foresters when collecting and examining quantitative data. Only in recent years has this neglect been realized. The application of statistical methods to forestry presents special difficulties that demand skilled attention and research, yet the properly trained forest statistician is an extremely rare being. The practice of statistical method is usually left to those who, owing to their preoccupation with other duties, must remain amateurs in the science, and who must from time to time stand in need of professional guidance. There is, as yet, no text-book of statistical theory or method written solely for the forester and dealing specially with his problems, and the accounts of statistical method in forestry text-books and instructional papers are slight or fragmentary. The two works under review in no way satisfy this need for adequate instructional literature, but they may help to fill the gap until such literature is produced.

The first book noted above is by D. D. Paterson, Reader in Agriculture at the Imperial College of Tropical Agriculture, Trinidad, and is a practical text-book for agriculturists engaged on research. It is simply and on the whole

clearly written, being designed for those who have no knowledge of the theory of statistics or of the elements of higher mathematics. There is a minimum of theoretical explanation, and the arguments may be followed by persons with very elementary mathematical training. The book begins with a short statement of the general principles of statistics in so far as these are related to the examination of means. Then follow chapters dealing with analysis of variance, goodness of fit, contingency tables, correlation, regression, and covariance; the last two-fifths of the book deal with field experimentation.

If one allows for the limited objective of this book, which is mainly to state certain statistical methods in such a fashion that they may be followed by those with elementary statistical training, this is a satisfactory work and will undoubtedly be of service to those for whom it is intended. Foresters need a work of this type, and they also will find it of service although they will not find that it necessarily answers all their problems. There are places in which more careful explanation or clearer statement is needed and at least two printing errors occur (on pages 112 and 171). A careful re-reading for a second edition should, however, eliminate details such as these.

The bibliography has not been examined in detail, but in the first section giving general works on statistical theory and practice three text-books are referred to by editions which had been superseded some time before the appearance of this book. These are Fisher's *Statistical Methods for Research Workers* (5th ed., 1934, instead of 6th ed., 1936—a 7th edition appeared in 1938), Yule's *Introduction to the Theory of Statistics* (9th ed., 1929, instead of 11th ed., 1937, revised in collaboration with M. G. Kendall), and Tippett's *The Methods of Statistics* (1st ed., 1930, instead of 2nd ed., 1937). These oversights are to be regretted, especially when, as in the case of Yule and Kendall, very considerable revision and improvement has been carried out.

The second work noticed here is of an entirely different nature. It consists of a series of carefully thought out examples intended to show, in the words of its title, the application of statistical methods to some Australian forest problems. There is practically no theoretical explanation, and it is assumed that the reader has some knowledge of statistics such, for example, as is given in the more elementary text-books or in some of the latest works on mensuration (e.g. Bruce, D., and Schumacher, F. X., *Forest Mensuration*, 1935, and Chapman, H. H., and Merritt, D. B., *Elements of Forest Mensuration*, 2nd ed., 1936). A previous work that is somewhat of this nature was written by W. G. Wright in 1925, *Statistical Methods in Forest-Investigative Work*, Dept. Int. Canada, For. Res. Br. Bull. 77). Wright's work is now somewhat out of date, particularly as regards the layout and the methods of statistical analysis necessary for field experiments. In this respect the work under review is a great advance, but whereas Wright gave a condensed explanation of statistical theory, Stoate and Lane Poole give none. The bulletin should, however, prove of considerable value to foresters with the necessary theoretical grounding, who need to use the statistical methods illustrated, but who are not trained statisticians.

A very interesting note by E. D. Van Rest which contains a review of the above Bulletin has been published in the *Empire Forestry Journal* [18. 1. 1939]. He gives a careful criticism and draws attention to places where statements might be clearer or more correct, and also to a number of typographical errors. This paper should be consulted by any who intend to use the Australian Bulletin. The chief interest in Van Rest's note lies in the stress he lays on the need to understand not so much how to work out particular methods as the conditions under which the results obtained by them are of value. He says: 'It is precisely for this reason that statistical methods should only be used by those who have a working knowledge of the conditions and assumptions on which the formulae are generated and of the conceptions which underlie the treatment of "spread out" or distributed data. It is now generally conceded that this understanding can be attained without a full study of the mathematics of statistics, and it is the purpose of this article to indicate a course of reading which, while not ruling out the need for consulting a statistician on occasion, will provide this understanding.' The syllabus he suggests is worthy of the consideration of those who have to teach statistical method or who study it by themselves. The bibliography he gives will also be of value.

The great danger in statistical method is, thus, that it may be used without proper understanding, and there is much need, at the present time, of literature, written specially for foresters, that will make such an understanding possible to those with limited mathematical training.

W. R. Day.

6 : 02.1 (43). DIETERICH, V. Forstliche Betriebswirtschaftslehre: Bd. I: Die wissenschaftliche Grundlegung. [**Theory of the economics of forest management: Vol. I: The scientific basis.**] Paul Parey, Hedemannstrasse 28 and 29, Berlin, S.W. 11. 1939. pp. 431.

The subject-matter of this volume is the study of the economic foundations of forest management with reference to individual enterprises. 'Individual enterprises' should not be mistaken for 'private forests'—every unit of management is considered an individual enterprise whatever the conditions of ownership. It should also be noted that 'enterprise' in this context is not meant to stress the role of the entrepreneur.

Apart from the introduction, the volume is divided into two parts: economic classification of forest enterprises (*Wirtschaftliche Betriebssystematik*) and analysis of the results of management (*Werts- und Erfolgsanalyse*). In the first part an attempt is made to show the economic variety of forest properties and to define the position of these properties within the domestic economy of different forest owners. Different types of enterprises are discussed, and grouped according to site and crop conditions, size and distribution, economic environment, legal status of the owner and the role of the forest in his domestic economy, aims and economic results of management, &c.

This classification of types of forest enterprise is based on and explained by a large variety of examples of existing German forests. Thus Dieterich's approach is rather empirical and mainly inductive, and the book contains few theoretical diagrams and formulae. This matter of fact treatment of the subject makes the second part of the volume a particularly valuable contribution. The results of management are separated into those components making up gross income on the one hand, and those making up expenditure on the other, and the interdependence of all contributing factors is discussed. This part of the book is based on data collected by individuals and corporate bodies during decades of permanent sample plot investigations and of forest accountancy, in the form of working plans, forest taxation, and sales records, &c.

By making the forest enterprise as a whole the subject of his investigations rather than the individual stand, and by centering attention on the analysis of the factors determining economic success or failure in management rather than on the determination or prediction of profitableness by means of formulae, the author deviates considerably from the traditional approach of the 'static' school of forest economists as represented by Hundeshagen, Heger, Endres, Martin, Busse, and others. Dieterich's book is certainly stimulating, and its numerous illustrations are admirably clear. A second volume is being prepared and will include the application of the principles evolved to the practical problems of evaluation, assessment of success, and planning.

I. K.

2 (73). WESTVELD, R. H. **Applied Silviculture in the United States.** John Wiley and Sons, Inc., New York. Chapman and Hall. Ltd., London. 1939. pp. 567.

This book is concerned with the forests of the United States as they are at the present time, the ecological background of their present development, and the problem of their management on a silvicultural basis, properly coordinated with economics of the forest industry. There is no doubt that this problem, for the country as a whole, is complex. Factors of environment, logging history, and changing economy, all differing in some degree with time and place, have and are contributing to this complexity. The author bases his work on the results of innumerable investigations that have been carried out in the forests and forest lands of the United States for years past, by universities, Government research stations, and private enterprise, and the comprehensive lists of references that follow each chapter bear ample testimony to the thoroughness of his survey of relevant literature.

In order to present his material clearly and systematically, the author has divided the country, including Alaska, into 18 regions, and devotes one chapter to each of these regions, following exactly the same procedure in each case. Each region is relatively more uniform than the whole country, as regards both natural and economic conditions, and is therefore easier to dissect, analyse, and prescribe for. The size and boundaries of each region are determined largely by the extent of adjacent forest associations that are relatively similar, or by the limits of a relatively uniform topography or climate. Size varies from that of the Central Hardwood Regions which include all of 5 states and parts of 8 others in the Central United States, bearing 55,000,000 acres of forested land and 15,000,000

acres of submarginal or abandoned land, to that of the Redwood Region, which is confined to a narrow strip along the coast of California, bearing approximately 1,000,000 acres of forested land.

An examination of any one chapter, as for example that of the Lake States Region, will show how the author has dealt with his material. In a brief note on location and land ownership it is pointed out that this region lies in the north half of the states of Michigan, Wisconsin, and Minnesota, and that the estimated area of forested land is 56,000,000 acres of which about 20 per cent. is under public ownership. The factors of topography, soil, and climate are then outlined, with particular attention to those that affect the establishment and growth of regeneration. The logging history of the region is discussed briefly, and it is pointed out how past treatment has affected the distribution and composition of the present forest. The forest types of the region are then dealt with individually. First the type is described from the ecological aspect as to composition and character of the forest, stand regeneration and stand development, and then it is discussed from the economic angle on the basis of growth and rotation, utilization and marketing problems, and financial considerations. Having thus analysed the present natural and economic conditions for a particular forest type, certain silvicultural methods, which appear to be most practical under the circumstances, are recommended. These include cutting methods to be applied to merchantable stands, cultural methods to be used for improving the quality and growth rate of young stands, and methods concerned primarily with regeneration, both by natural and artificial means. Brief mention is made of the related problems of slash disposal, disease and insect attack, and damage by animals and logging.

As all recommendations are based on the results of work that has been carried out in the United States, it is clear that a silvicultural practice is being developed to meet the particular needs and conditions of that country. Westveld's description of the natural and economic conditions is clear and concise, and his correlation of adjustments in silvicultural technique with changes in these conditions is most logical. This book should go far towards simplifying the problem of silviculture, both for the student and the practising forester.

J. W. B. S.

11.2 : 02.2 [43]. Woelfle, M. **Silviculture and forest meteorology: practical inferences from the investigations of the Institute of Forest Meteorology, Munich, during the period 1924–38.** J. Neumann, Neudamm and Berlin. 1939. pp. 75.

Dr. Woelfle's booklet was written with the purpose of acquainting foresters with the practical results of investigations carried out by the staff of the Forest-Meteorological Institute of Munich during the period 1924–38. The author does not presume any specialized meteorological knowledge nor does he quote any but the most important and readily accessible references. A detailed division of the subject-matter into sections and sub-sections, clear diagrammatic illustrations, and a fairly lucid style, make for easy reading. Chapter I is introductory and discusses the history, present state, and the importance of forest meteorology. The author points out that recent progress has been due mainly to a unification of micro-climatic research methods and an improvement in the apparatus employed. The first part of Chapter II deals with radiation frosts in relation to topography, the form of the canopy, and the elevation of forests above sea level, and with the prevention of frost damage. In the second part of the chapter temperature, as influenced by topography and the structure of forests, is discussed in relation to management. It is pointed out that forests consisting of several stories protect the soil from heat more effectively than one-storied woods. Chapters III, IV, and V deal briefly with light, precipitations, and atmospheric humidity. Chapter VI is devoted to investigations on (1) wind (*a*) within the stand, (*b*) just above the canopy, and (*c*) in the zone of the 'lateral canopy' [Bestandsmantelzone], (2) the shelter effect of forests and hedges, and (3) storm damage and its prevention. A simple type of shelterbelt arrangement is discussed and illustrated. Chapter VII deals with evaporation and the protection of the soil against undue losses of humidity. Finally, suggestions are made for future collaboration between scientists and practical foresters with a view to advancing forest meteorology.

I. K.

45.3 : 13.21.85 : 02.1 (4). Hering, M. Die Blattminen Mittel- und Nord-Europas, einschliesslich Englands. **[The leaf-mining insects of Central and Northern Europe, including England.]** Verlag Gustav Feller, Neubrandenburg. 1935–7. pp. 631.

33.24. GRANT, J. **Wood pulp.** The Chronica Botanica Company, Leiden, Holland. 1938. pp. 209.

94.3 (4). Forêts privées: gestion, régime fiscal, reboisement des terrains incultes, propagande forestière. [**Private forests: management, finance, reforestation of uncultivated lands, forestry propaganda.**] Vol. I—Europe. Institut International d'Agriculture, Villa Umberto I, Rome. 1938. pp. 386.

98.2 : 09.1 (2). LOWER, A. R. M. **The North American Assault on the Canadian forest:** a history of the lumber trade between Canada and the United States: with studies of the forest industries of British Columbia by W. A. Carrothers, and of the forest industries in the Maritime Provinces by S. A. Saunders. Ryerson Press, Toronto: Yale University Press, New Haven: Oxford University Press, London. 1938. pp. 377.

11.4 : 02.1. BLANCK, E. Handbuch der Bodenlehre: Erster Ergänzungsband. [**Manual of pedology: Supplement No. 1.**] Verlag von Julius Springer, Berlin. 1939. pp. 621.

NOTES FROM ANNUAL REPORTS

Reports examined include: *Australia*: Annual report of the Commonwealth Forestry Bureau for the year 1938. *British Columbia*: Report of the Forest Branch for the year ended 31st December 1938. *British Honduras*: Report of the Forest Department of British Honduras for the year 1938. *Great Britain*: Nineteenth annual report of the Forestry Commissioners for the year ending 30th September 1938. *Hong Kong*: Annual report of the Superintendent, Botanical and Forestry Department, for the year 1938. *India*: Forest research in India, 1937–8. Pt. II. Provincial reports. *Kenya*: Forest Department annual report, 1938. *Latvia*: Latvijas mežu statistika un Mežu departmenta darbiba 1937–8. (Latvian forest statistics and activities of the department of Forests, 1937–8). *Malaya and Brunei*: Annual report on forest administration in Malaya, including Brunei, for the year 1938. *Madras* (1): Administration report of the Forest Department of the Madras Presidency for the year ending 31st March, 1938. Vols. I and II. *Madras* (2): Annual report on silvicultural research in the Madras Presidency for the year 1937–8. *New Zealand*: Annual report of the Director of Forestry for the year ended 31st March 1939. *Nigeria*: Annual report on the forest administration of Nigeria for the year 1938. *Northern Rhodesia*: Annual report of Department of Agriculture for the year 1938. *Norway*: Årsberetning fra det Norske Skogselskap for 1938. (Annual report of the Norwegian Forestry Society for 1938). *Nyasaland*: Annual report of the Forestry Department for the year ended 31st December 1938. *Sarawak*: Annual report on the Forest Department for the year 1938. *Sweden*: Domänverket år 1938 av Kungl. Domänstyrelsen. (Annual report of the Kungl. Domänstyrelsen on State forests, 1938). *Trinidad and Tobago*: Administration report of the Conservator of Forests, for the year 1938. *United States* (1): Annual Investigative Report, Lake States Forest Experiment Station, U.S.D.A. Forest Service, 1939. *United States* (2): Annual report of the Pacific Northwest Forest and Range Experiment Station for the calendar year 1938. U.S.D.A. Forest Service. *United States* (3): Eighteenth Annual Report of the Southern Forest Experiment Station, 1st January–31st December 1938. U.S.D.A. Forest Service.

The numbers in brackets indicate the pages of the reports to which the annotations refer.

SILVICULTURE

Australia. Softwood planting included 770 acres of Monterey Pine and 55 acres of Western Yellow Pine (1). Investigations indicate that the rapid increase in diameter growth following heavy thinning is the result of tree adjustment to external forces—the addition of sway stimulus wood—rather than simple response to release. Stimulus woods are undesirable in lumber production (6). The watering of Monterey Pine trees in plantation has resulted in an increase in the rate of terminal shoot elongation as well as in affecting cone production and the time and rate of emergence of needles (7).

British Columbia. The cost of removing the first crop of annual weeds from a seed-bed, just before the seedling shoots appear, can be considerably reduced by passing the hot flame of a pressure torch over the surface of the soil (24).

British Honduras. In a clear-cut strip in second-growth Mahogany (*Swietenia macrophylla*), running at 45° to the prevailing wind but at right angles to the wind of greatest force, plentiful natural regeneration was obtained within 4 to 5 chains of the seed trees (6). The chief feature of the clay soils, which support luxuriant hardwood growth, is a semi-pan of ferruginous concretions, the height of which, together with the clay fraction, determines the period of waterlogging and so indirectly the mortality of new regeneration (7).

Great Britain. Pure coarse sand or fine gravel are used successfully as covering for seed-beds of small-seeded coniferous species (40). *Pinus contorta* in mixture with Sitka Spruce (*Picea sitchensis*) has been planted with success on poorer types of peat in north and west Scotland and on poor upland heaths. Japanese Larch (*Larix kaempferi*) also grows on poor peat (41).

Hong Kong. Direct sowing of the seed of *Pinus massoniana* gives better results than nursery production and planting. Higher germination is obtained from broadcast sowing than from pit sowing (5).

India. (Assam)—The planting of *Artocarpus chaplasha* under an overstorey of *Gmelina arborea*

was successful (12). (Bengal)—Exotics showing promise at 5,000 ft. altitude are *Pinus khasya*, *P. thunbergii*, *Cupressus torulosa*, *C. cashmeriana*, *Juniperus virginiana*, and *Acacia dealbata*; at 8,000 ft., *Alnus incana* and *Larix leptolepis* (16–17). Planting of *Dipterocarpus turbinatus* and *D. pilosus* under *Gmelina arborea* and *Tectona grandis* was successful and inexpensive (17–18). (Bombay)—Plantation Teak at 12 ft. × 12 ft. produces better girth increment than at 6 ft × 6 ft., 9 ft. × 9 ft., or 15 ft. × 15 ft. (27). (Coorg)—Seed of *Santalum album* from which pulp had been removed showed a germination of 71 per cent. compared with 23 per cent. for untreated seed (46). Early stump planting is the most successful method of regenerating Teak both as regards subsequent survival and height growth (47). The *taungya* crop of ragi greatly retards the growth of young Teak (49). (Punjab)—Natural regeneration in Kail (*Pinus excelsa*) forests is improved by removal of humus. This, together with restricted opening of the canopy, is beneficial to regeneration of *Abies pindrow* and *Picea morinda* (75). Agaves are valuable in erosion control (78). Planting espacements for Shisham (*Dalbergia sissoo*) of 5 ft. × 10 ft. or 6 ft. × 10 ft. are better than 8 ft. × 10 ft. and 10 ft. × 10 ft. both as regards production and weed control (80). (United Provinces)—*Eugenia jambolana* and *Holoptelea integrifolia* develop well under dense shade of Khair (*Acacia catechu*) (85).

Kenya. 2,970 acres were planted, mainly in conjunction with controlled shifting cultivation. The principal species used were Pencil Cedar (*Juniperus procera*) and other indigenous timbers, and exotic species such as Cypress and Blackwood (*Acacia melanoxylon*) and fast-growing Eucalypts and Black Wattle, the last two species to be used for fuelwood (13–15).

Latvia. 10,193 ha. have been artificially regenerated; of this 1,750 ha. were planted and 8,443 ha. sown. Natural regeneration has been obtained on 7,905 ha. (204).

Malaya and Brunei. The area intensively regenerated by 'commercial regeneration fellings' (pole and seeding fellings in places where inferior species are marketable) and 'regeneration improvement fellings' (poison-girdling of unsaleable inferior species combined with cleanings of the advance growth of desirable species) has increased by 5,499 acres during the year and the area in process of conversion has risen by 7,123 acres (5). In many districts the medium-powered sawmill is replacing the hand sawyer and it is becoming possible to exploit species that were formerly converted into firewood or girdled. This method demands lighter pretreatment than the two methods already mentioned, since more exploitable trees must be left (5–6). Direct sowings of Merbau (*Afzelia bakeri*) give promise of success (6).

Madras (1). Teak plantations:—1,246 acres were planted bringing the total to 23,300 acres (2). Mahogany (*Swietenia macrophylla*) grows better from transplants than from stumps (16). On unsuitable sites irrigation increases the growth rate of Teak for the first 5 years after planting (18).

Madras (2). The removal of all vegetation except top canopy benefits the establishment and growth of regeneration of *Hopea parviflora* (6). Boiling-water treatment improved the germination capacity of some Acacias, *Bauhinia purpurea* and *Pinus longifolia*. Cold-water treatment was beneficial to some other species (*Gluta*, *Pterocarpus*, *Vitex*, and *Xylia*). Concentrated sulphuric acid hastened and improved the germination of *Cassia auriculata*, *C. fistula*, and *C. marginata*. Fermenting improved that of *Terminalia chebula* (10–12). Stump planting is the best method of artificial regeneration for *Dalbergia latifolia*, *Terminalia crenulata*, and *Artocarpus hirsuta*, transplanting for *Pterocarpus dalbergioides* and direct sowing for *Xylia xylocarpa* (27–9). In early stump planting of Teak the top of the shoot should be flush with ground (47). Planting Mahogany (*Swietenia macrophylla*) under a shade crop such as *Trema orientalis* is effective in minimizing the attack of the shoot-borer *Hypsipyla robusta* (51, 60). Before direct sowing with the species *Acacia planifrons*, *Albizzia amara*, *Cassia auriculata*, *C. siamea*, *Dolichandrone crispa*, and *Zizyphus jujuba*, burning of the area is essential and soil working is beneficial (65). Basket planting is more efficient than transplanting or direct sowing for the species *Dysoxylum malabaricum*, *Gluta travancorica* and *Vateria indica* (93).

New Zealand. 430,742 acres of plantations (mainly exotics) have been established by State (12–13).

Nigeria. 'Bush' nurseries are being used successfully; established in high forest under dense natural shade, they do not require artificial shade or watering. The soil between rows is cultivated (pulverized) during the dry season (7).

Northern Rhodesia. Extracting the seeds of Mukwa (*Pterocarpus angolensis*) from the pods and soaking them in cold water for 24 hours appears to be the best method for improving germination (21). Planted root and shoot cuttings from 1-, 2-, and 3-year seedlings of Mukwa showed a 100 per cent. survival (22). Of the Pines that have been infected with mycorrhizal fungus and planted, *Pinus patula*

is growing rapidly, and *P. caribaea*, *P. taeda*, *P. teocote*, and *P. longifolia* are doing fairly well, particularly the first three (26).

Norway. About ½ million more seedlings were planted out than in the previous year. In southern Norway the seed production of Spruce was poor and seed for 1939 has been purchased from Germany: northern Norway, on the other hand, has produced enough Spruce seed to cover its requirements for several years (2–3).

Nyasaland. Successful natural regeneration follows heavy thinning and group and strip fellings in plantations of *Widdringtonia whytei*. Fertile cones have been found on 5- and 6-year old *Pinus patula* (22). Successful regeneration of such timber species as Mlombwa (*Pterocarpus angolensis*) and Ntangatanga (*Albizzia* spp.) has been obtained by stump planting vigorous nursery stock. Various introduced species of *Pinus* have been successfully planted, using soil inoculated with mycorrhiza (23).

Sarawak. A 4-acre plantation of cotyledon seedlings of Jelutong (*Dyera lowii*) was established with apparent success. Preliminary investigations indicate that the removal of the secondary forest canopy, following underplanting with species of *Shorea*, should be done in two operations, 1 and 2 years after planting (6).

Sweden. Seed production by Spruce was poor in the southern regions but satisfactory in the north of the country (33). An investigation of the poor yield of certain woods has been started and is expected to be completed by 1940; it will include a survey of the effects of soil preparation, planting, and cleaning operations (34).

Trinidad and Tobago. Teak planting has proved successful in the past, and it is planned to expand this project (3). Other species that have been successfully established are Guatecare (*Eschweilera subglandulosa*), Locust, Tapana (*Hieronyma caribaea*), and Cypre (*Cordia alliodora*). Thinned Teak stands can be successfully underplanted with Balata (*Mimusops balata* var. *cruegeri* Pierre). The burning of slash on nursery beds of a stiff clay soil prior to sowing with Cedar and Cypre resulted in better survival and health of seedlings (6). Manurial treatment with Nicifos has a beneficial effect on chlorotic Teak trees (7).

United States (1). Optimum conditions for the extraction of White Pine seed are maximum relative humidity of 40 per cent. and temperature 40° F. for 8 to 12 hours. For Jack Pine 30 per cent. relative humidity and 170° F. for 6 hours. Red Pine and White Pine seed that has been air dried at 25 per cent. relative humidity and stored in sealed containers at 30° F. will remain viable for 4 and 5 years respectively. The rate and total amount of germination for White Pine can be increased by stratification of seed at 50° F. for 30 days. For Tamarack at 41° F. for 30 days (9). Available phosphorus in nursery beds increases root development and drought hardiness, and much available nitrogen reduces drought resistance (10–11). A nursery bed treatment giving uniformly good results was the addition, per acre, of 14 to 20 tons of peat, dry weight, 300 to 400 lb. of ammonium sulphate, 600 lb. of superphosphate, and 160 lb. of potash (11). Nursery stock can be stored at 38° to 40° F. for 4 weeks with little harm (12). Pine transplants survive better and grow faster than seedlings (14). Satisfactory natural regeneration of Jack Pine requires extensive exposure of mineral soil, the broadcast scattering of slash and the placing of slash so that the cones are close to the ground (15). Spring germination of Jack Pine seedlings gives higher survival than fall germination (16). Light cutting in the northern hardwood type is preferable to moderate or heavy cutting as regards the quality of growth of the residual stand (16–17).

United States (3). In 5 years following improvement cutting and girdling on two plots in second-growth stands of Shortleaf-Loblolly-hardwood type, merchantable board-foot volumes increased 43 and 75 per cent. as compared with 32 and 37 per cent. on unimproved plots (3). The removal of all competing vegetation over a period of 5 years has resulted in an average growth of Longleaf Pine seedlings (9 ft.) 3 times that on unimproved sites. In Southern Pine seedlings symptoms of nutrient deficiency (reduced development) were most pronounced in cultures lacking nitrogen, and least in those lacking phosphorus (8). A seed moisture content of 6 to 9 per cent. and a temperature of 38° F. appear to be optimum conditions for the storage of Longleaf Pine seed (11). Conditions of shading and defoliation control the storage of food reserves and are vital factors in the initial survival of seedlings planted in the field (12).

EXTRACTION, UTILIZATION, AND MARKETING

Latvia. The total cut in State forests during 1937/8 was 5,814,044 cu.m. Of this 59·2 per cent. was timber (mainly Pine and Spruce), 37·6 per cent. firewood, 2·5 per cent. faggots, and 0·7 per cent. stumpwood (200–1).

Malaya and Brunei. The total production of timber rose from about 16 million cu. ft. in 1937 to about 19 million cu. ft. in 1938; of this 34 per cent. came from reserved forests (9). Excluding Brunei, the total out-turn of Jelutong reached a record figure of 2,394 tons, which brought in $265,956. Brunei Jelutong is of a lower grade, being derived from a different species; the total production in Brunei was 166 tons which yielded a revenue of $8,308 (10).

New Zealand. Modern logging equipment, including a 90 h.p. Diesel caterpillar tractor and arch equipment, has been successfully demonstrated under suitable conditions of topography and soil. The arch equipment increases the quantity hauled by 50 to 100 per cent. (14, 23). Revised rules have been adopted for the grading of sawn timber and other forest products (24–5). The seasoning of green timber of Eucalyptus and Larch by immersion in a strong salt solution has eliminated checking and increased the strength and serviceability of these timbers when creosoted (26). Of the group of wood preservatives that are used with a volatile oil solvent, it is believed that pentachlorphenol is the most efficient as regards toxicity, permanency, and cost (27).

Nigeria. Parquet blocks of Opepe (*Sarcocephalus diderrichii*), Okan (*Cylicodiscus gabunensis*), Otutu (*Cistanthera papaverifera*), and Anyeran (*Distemonanthus benthamianus*) were used in an experimental floor in the new Forestry Headquarters building at Ibadan (6). Preservative treatment schedules were determined for shingles of Abura (*Mitragyna stipulosa*), Agba (*Gossweilerodendron balsamiferum*), and Arere (*Triplochiton scleroxylon*), and the absorption capacity of billets of Arere and Afara (*Terminalia superba*) was determined for various solutions (10). Tests indicate that a 1 per cent. solution of 'Dowicide' or 'Santabrite' is a satisfactory protection against staining of local timbers during the period of seasoning (10). Sleepers of Agboin (*Piptadenia africana*) and Apa (*Afzelia africana*) that were laid green are in good condition after 2 years' service and those of treated Afara are durable (10–11).

Norway. Total wood production in 1937–8 amounted to 7,243,080 cu.m. of timber and 60,447 cu.m. of small wood (20).

Sarawak. The wood of Belian (*Eusideroxylon zwageri*) remains entirely sound after 3 years' test in a 'graveyard'. Two preservatives, one having a metallic salt base and the other a creosote base, are the most efficient of a number of local preservatives tested, giving almost complete protection. The approximate total wood production, apart from minor products was: timber 20,000 tons, firewood 56,000 tons, charcoal 4,500 tons (7).

Sweden. The total cut in State forests in 1938 amounted to 5,518 cu.m.

United States (3). The application of 5 and 20 per cent. solutions of sulphuric acid to a freshly streaked face on Longleaf and Slash Pine appears to stimulate gum flow. Advance streaking on Slash Pine, 21 weeks and 9 weeks before regular chipping, resulted in an increase in total yield of 5 and 4 per cent. respectively for a 32-streak season (15).

MINOR PRODUCE

Latvia. Peat is an important minor forest product and its use is encouraged in the interests of national economy. 575 tons of charcoal were produced (202).

Nigeria. The exploitation of Niger gutta has proved successful (13).

PROTECTION

British Columbia. A technique has been developed for taking panoramic photographs for use at lookout stations in locating and reporting fires (21). The use of reliable, two-way portable radios in place of the telephone has reduced cost and increased efficiency in reporting fires and organizing firefighting (49).

Latvia. Fire lines are made by removing litter in all strips adjacent to railways and roads (203–4). Cockchafers and *Hylobius abietus* are the chief forest pests. Trap ditches are used against the latter (204). *Lophodermium pinastri* is controlled by dusting with Bordeaux mixture in all nurseries, and to some extent in the woods. Trees attacked by other diseases are promptly cut down (204).

Madras (1). The introduction of the cochineal insect has resulted in almost complete eradication of Prickly-pear from the forests (11).

New Zealand. Research on the correlation of weather conditions and fire hazard has resulted in increased efficiency in fire detection (18). In a Beech (*Nothofagus* spp.) forest that had suffered from earthquake shock but had not been destroyed, the population of a buprestid beetle (*Nascioides enysii*) increased considerably (19).

Northern Rhodesia. Consistent early burning is used as a successful fire protection method and ensures the continual development of established regeneration (25).

Nyasaland. The annual hoeing and planting of ridges along contours 3 to 4 ft. apart with slightly lower mounds raised between the ridges has been found effective for cultivating sloping ground (42, 50).

Sweden. A reduction in bark-beetle attack is attributed to control measures, including the barking of refuse wood and the use of trap trees, which were instituted in collaboration with the Entomological Research Department.

United States (1). The elimination of grazing from wooded areas is most important in flood control and will reduce run-off to practically nothing (22–3).

United States (2). Rotten wood having a moisture content up to 40 per cent. can be ignited by cigarettes. Matches will not ignite rotten wood of more than 8 per cent. moisture content, but will ignite bracken fern, cheat grass, and Pine needles with moisture content up to 35 per cent. Tests with chemicals for extinguishing fires indicate that the best available are less than twice as effective as water (8).

United States (3). Bermuda grass, Crab-grass, and Korean lespedeza gave satisfactory results in soil conservation tests when seeded on prepared cut banks, particularly with the use of a top dressing 3 in. deep and when seeding was done in the spring rather than the fall (26). High summer temperatures cause a decrease in the incidence of certain stain fungi. Bark beetles, notably *Ips* and *Orthotomicus*, and ambrosia beetles carry spores of some important stain fungi (31). Diphenyl shows promise as a chemical spray for the control of ambrosia beetles in green lumber. Data indicate that *Lyctus* beetles will not attack boards with moisture content of more than 15 per cent. (32). Arsenicals and chlorinated phenols show promise as preservatives of fibre boards. Birds destroy a large part of the annual fall of Longleaf Pine seed (33).

ECONOMICS, MANAGEMENT, AND POLICY

Australia. An estimated 200,000,000 sup. ft. of Klinki Pine (*Araucaria klinkii*) in the Bulolo Valley, New Guinea, is being put under sustained yield management with a 40-year rotation (1–2).

British Columbia. A total of 9,445 aerial photographs were taken covering an area of 7,085 miles and required 119 hours and 39 minutes' flying-time (21). Volume and yield tables have been prepared for Red Alder (*Alnus rubra*) (23).

Latvia. All State forests were brought under management plans during 1937–8 (200). Since 1937 all felling for sale must be approved by a State inspector in private forests of more than 1 ha. in area. Felling for home use is allowed up to an amount equivalent to the increment of 10 years. The law provides for free regeneration by the State of felled areas in private forests (205).

Malaya and Brunei. The forest revenue of Malaya was $2,409,094 in 1938. The surplus over expenditure, which amounted to $1,169,048, was the largest since 1927. Reserved forest of all kinds now totals 10,602 sq. miles: the programme of reservation is fairly complete except in Trengganu and parts of Pahang, Kelantan, and Brunei (2). The Resident of Perak has appointed a Regional Planning Committee, of which the State Forest Officer is a member, to control the alienation of land and to adjust the conflicting demands of agriculture, forestry, and mining.

Nigeria. The report of a vegetational survey conducted from Sokoto indicates that southern encroachment of the Sahara is not apparent and that existing adverse conditions associated with desiccation are the result of the activities of man and domestic animals. Recommendations have been made for the practical planning of this area (2–3).

Norway. An effort is being made to secure larger areas of protection forest by putting a premium on any area over 200 dekares in extent (10). Two new experimental demonstration areas and one model wood have been set up; these will be used largely for propaganda purposes (11–13).

Nyasaland. The officers of the departments of Agriculture, Veterinary Services, and Forestry, are co-operating in the planning and undertaking of land-utilization work.

Trinidad and Tobago. Aerial photographs were used in the preparation of two vegetation maps on the scale of 1 : 20,000 (4). It is planned to establish forest labour-settlements. A labourer who agrees 'to take up a 1-acre Teak contract each year and to work a minimum of 156 days a year, if called upon' is given 'a rent-free house site and garden, free house-building materials and fuel and is guaranteed 156 days' minimum work a year' (8–9).

United States (1). Areas on which grazing and forest production are combined have a much lower total financial yield than similar areas utilized either as pastures or woodlots (8).

LIST OF ABBREVIATIONS

(Based on the *World List of Scientific Periodicals*)

Act. et C. R. Ass. Colon.-Sci.	Actes et Comptes Rendus de l'Association Colonies-Sciences. Paris.
Agric. Live-Stk. India	Agriculture and Live-Stock in India. Calcutta.
Allg. Forst- u. Jagdztg.	Allgemeine Forst- u. Jagdzeitung. Frankfurt a. M.
Amer. J. Bot.	American Journal of Botany. Lancaster, Pa.
Ames For.	Ames Forester. Ames, Iowa.
Angew. Bot.	Angewandte Botanik. Berlin.
Ann. Bot., Lond.	Annals of Botany. London.
Ann. Bot., Roma	Annali di botanica. Rome.
Ann. ent. fenn.	Annales entomologici fennici. Helsinki.
Ann. Exp. for., Zagreb	Glasnik za Šumske Pokuse [Annales pro experimentis foresticis]. Zagreb.
Ann. Mo. bot. Gdn.	Annals of the Missouri Botanical Garden. St. Louis, Mo.
Anz. Schädlingsk.	Anzeiger für Schädlingskunde. Berlin.
Arb. physiol. angew. Ent. Berl.	Arbeiten über physiologische und angewandte Entomologie. Berlin-Dahlem.
Aust. For.	Australian Forestry. Perth, W.A.
Aust. Timb. J.	Australian Timber Journal. Sydney.
B.C. Lumberm.	British Columbia Lumberman. Vancouver.
Ber. dtsch. chem. Ges.	Bericht der Deutschen Chemischen Gesellschaft. Berlin.
Ber. schweiz. bot. Ges.	Bericht der Schweizerischen Botanischen Gesellschaft. Bern.
Bio-chem. J.	Bio-chemical Journal. Liverpool.
Biol. Rev.	Biological Reviews and Biological Proceedings of the Cambridge Philosophical Society. Cambridge.
Black Rock For. Bull.	Black Rock Forest Bulletin. Cornwall-on-the-Hudson.
Bot. Gaz.	Botanical Gazette. Chicago.
Bot. Notiser	Botaniska Notiser. Lund.
Bot. Rev.	The Botanical Review. Lancaster, Pa.
Bull. agric. Congo belge	Bulletin agricole du Congo Belge. Brussels.
Bull. Amer. met. Soc.	Bulletin of the American Meteorological Society. Milton, Mass.
Bull. Com. A. O. F.	Bulletin du Comité d'études historiques et scientifiques de l'Afrique occidentale française. Paris.
Bull. Dom. For. Serv.	Dominion Forest Service Bulletin. Ottawa.
Bull. ent. Minist. Terres Québec.	Bulletin du Service entomologique du Ministère des Terres. Quebec.
Bull. ent. Pologne	Polskie Pismo entomologiczne. Lwów.
Bull. ent. Res.	Bulletin of Entomological Research. London.
Bul. Fac. Şti. Cernăuţi	Buletinul Facultăţii de ştiinţe din Cernăuţi.
Bull. imp. Inst., Lond.	Bulletin of the Imperial Institute. London.
Bull. Jard. bot. Brux.	Bulletin du Jardin botanique de l'État à Bruxelles.
Bull. Ohio agric. Exp. Sta.	Bulletin of the Ohio Agricultural Experiment Station. Wooster.
Bull. Pa. agric. Exp. Sta.	Bulletin of the Pennsylvania Agricultural Experiment Station. State College, Pa.
Bull. Rech. soudan.	Bulletin de Recherches Soudanaises. Kouloula [French Sudan].
Bull. Soc. for. Belg.	Bulletin de la Société forestière de Belgique. Brussels.
Bull. Soc. for. Franche-Comté	Bulletin de la Société forestière de Franche-Comté et Belfort. Besançon.
Bull. Torrey bot. Cl.	Bulletin of the Torrey Botanical Club. New York.
Calif. Citrogr.	California Citrograph. Los Angeles.
Canad. J. Res.	Canadian Journal of Research. Ottawa.
Chem. Ind. Rev.	Chemistry and Industry Review. London.
Chem. metall. Engng.	Chemical and Metallurgical Engineering. New York.
Chem. Prod.	Chemical Products and Chemical News. London.
Chem. Tr. J.	Chemical Trade Journal and Chemical Engineer. Manchester.
Chim. et Industr.	Chimie et Industrie. Paris.
Chron. bot.	Chronica Botanica. Leiden.
Circ. U.S. Bur. Stand.	Circular. United States Bureau of Standards. Washington.
Contr. biol. Lab. Sci. Soc. China	Contributions from the Biological Laboratory of the Science Society of China. Nanking.
Cornell Univ. agric. Exp. Sta. Mem.	Cornell University Agricultural Experiment Station Memoir. Ithaca, N.Y.
C. R. Acad. Sci. Paris	Compte rendu de l'académie des Sciences. Paris.
C. R. Acad. Sci. U.R.S.S.	Compte rendu de l'académie des sciences de l'U.R.S.S. Leningrad.
Dansk Skovforen. Tidsskr.	Dansk Skovforeningens Tidsskrift. Copenhagen.
E. Afr. agric. J.	East African Agricultural Journal. Nairobi.
Ecol. Monogr.	Ecological Monographs. Durham, N.C.
Emp. For. J.	Empire Forestry Journal. London.

Ernähr. Pfl.	Ernährung der Pflanze. Berlin.
Estate Mag.	Estate Magazine. London.
Farbenztg.	Farbenzeitung. Berlin.
Finsk. PappTidskr.	Finsk Pappers- och Trävarutidskrift [Finnish Paper and Timber Journal]. Helsinki.
For. Chron.	Forestry Chronicle. Toronto.
For. Prod. Res. Rec., Lond.	Forest Products Research Records. Department of Scientific and Industrial Research. London.
Forstl. Forsøgsv. Danm.	Det Forstlige Forsøgsvæsen i Danmark. Copenhagen.
Forstwiss. Cbl.	Forstwissenschaftliches Centralblatt. Berlin.
Geogr. J.	Geographical Journal. London.
Holz	Holz als Roh- und Werkstoff. Berlin.
Ill. Carp. Build.	Illustrated Carpenter and Builder. London.
Imp. Bur. Hort. Plantat. Crops Techn. Commun.	Imperial Bureau of Horticulture and Plantation Crops Technical Communication. East Malling.
Indian For.	Indian Forester. Lahore, Punjab.
Indian For. Rec. [n.s.] Silviculture	Indian Forest Records [New Series]. Silviculture. Delhi.
Indian For. Rec. [n.s.] Utilization	Indian Forest Records [New Series]. Utilization. Delhi.
Insecta matsum.	Insecta matsumurana. Sapporo, Japan.
Inst. Leafl.	Institute Leaflet. Imperial Forestry Institute. Oxford.
Inst. Pap.	Institute Paper. Imperial Forestry Institute. Oxford.
Int. Rev. Timb. Util.	International Review on Timber Utilization. Bruxelles.
Iowa St. Coll. J. Sci.	Iowa State College Journal of Science. Ames, Iowa.
J. agric. Res.	Journal of Agricultural Research. Washington.
J. amer. chem. Soc.	Journal of the American Chemical Society. Easton, Pa.
J. Arnold Arbor.	Journal of the Arnold Arboretum, Harvard University. Lancaster, Pa.
J. Bot., Lond.	Journal of Botany. London.
J. Coun. sci. industr. Res. Aust.	Journal of the Council for Scientific and Industrial Research, Australia. Melbourne.
J. Ecol.	Journal of Ecology. London.
J. econ. Ent.	Journal of Economic Entomology. Geneva, N.Y.
J. For.	Journal of Forestry. Washington.
J. for. suisse	Journal forestier suisse. Berne.
J. Land Agents' Soc.	Journal of the Land Agents' Society. London.
J. Res. U.S. Bur. Stand.	Journal of Research of the National Bureau of Standards. Washington.
Kew Bull.	Bulletin of Miscellaneous Information [Royal Botanic Gardens, Kew]. London.
Kolonialforstl. Mitt.	Kolonialforstliche Mitteilungen. Tharandt.
K. VetHøjsk. Aarsskr.	Kongelige Veterinær- og Landbohøjskoles Aarsskrift. Copenhagen.
Leafl. Aust. For. Bur.	Leaflet. Australian Commonwealth Forestry Bureau. Canberra.
Malay. agric. J.	Malayan Agricultural Journal. Kuala Lumpur.
Malay. Forester	Malayan Forester. Kuala Lumpur.
Mech. Engng. N.Y.	Mechanical Engineering. New York.
Medd. norske Skogforsøksv.	Meddelelser fra det norske Skogforsøksvesen. Oslo.
Medd. Skogsförsöksanst. Stockh.	Meddelanden från Statens Skogsförsöksanstalt. Stockholm.
Méx. for.	México forestal. México, D.F.
Misc. Publ. U.S. Dep. Agric.	Miscellaneous Publication of the United States Department of Agriculture. Washington.
Mitt. Forstwirt. Forstwiss.	Mitteilungen aus Forstwirtschaft und Forstwissenschaft. Hannover.
Mitt. LandesForstverw. Bayerns	Mitteilungen aus der Landesforstverwaltung Bayerns. Munich.
Nature, Lond.	Nature. London.
Ned. Boschb.-Tijdschr.	Nederlandsche Boschbouw-Tijdschrift. Wageningen.
N.Z. J. Sci. Tech.	New Zealand Journal of Science and Technology. Wellington.
Paint Tech.	Paint Technology. London.
Palest. J. Bot.	Palestine Journal of Botany. Jerusalem.
Pap. Mich. Acad. Sci.	Papers of the Michigan Academy of Science, Arts and Letters. New York.
Pap. roy. Soc. Tasm.	Papers and Proceedings of the Royal Society of Tasmania. Hobart.
Philipp. J. For.	Philippine Journal of Forestry. Manila.
Philipp. J. Sci.	Philippine Journal of Science. Manila.
Photogramm. Engng.	Photogrammetric Engineering. Washington.
Plant. Manual., Rubb. Res. Inst. Malaya	Planting Manual. Rubber Research Institute of Malaya. Kuala Lumpur.
Plant Physiol.	Plant Physiology. Lancaster, Pa.
Planta polon.	Planta Polonica. Warsaw.
Proc. Amer. Wood Pres. Ass.	Proceedings of the American Wood Preservers' Association. Baltimore.
Proc. ent. Soc. B.C.	Proceedings of the Entomological Society of British Columbia. Victoria.
Proc. ent. Soc. Wash.	Proceedings of the Entomological Society of Washington.
Proc. Ind. Acad. Sci.	Proceedings of the Indian Academy of Science. Brookville.
Proc. Leeds phil. lit. Soc.	Proceedings of the Leeds Philosophical and Literary Society. Leeds.

LIST OF ABBREVIATIONS

Proc. Linn. Soc. N.S.W.	Proceedings of the Linnean Society of New South Wales. Sydney.
Puutek. tutkim. Kannatu. Tech. Publ.	Puuteknikan Tutkimuksen Kannatusyhdistys. Teknillisiä Tiednonantoja [Foundation of Forest Products Research of Finland. Technical Publication]. Helsinki.
Qd. agric. J.	Queensland Agricultural Journal. Brisbane.
Quart. J. For.	Quarterly Journal of Forestry. London.
Quart. J. R. met. Soc.	Quarterly Journal of the Royal Meteorological Society. London.
Rec. Trav. bot. néerland.	Recueil des travaux botaniques néerlandais. Nimègue.
Rep. latv. For. Res. Sta.	Latvijas Mežu Petišanas Stacijas Raksti. [Reports of the Latvian Forest Research Station]. Riga.
Rep. U.S. Bur. Stand.	Reports of the United States Bureau of Standards. Washington.
Res. Pap. U.S. Bur. Stand.	Research Paper. United States Department of Commerce, National Bureau of Standards. Washington.
Res. Stud. St. Coll. Wash.	Research Studies. State College of Washington. Pullman.
Rev. Bot. appl.	Revue de botanique appliquée et d'agriculture tropicale. Paris.
Rev. Eaux For.	Revue des Eaux et Forêts. Paris.
Rev. int. Bois	Revue Internationale du Bois. Paris.
Rev. Pădurilor	Revistă Pădurilor, Bucureşti.
Rev. Zool. Bot. afr.	Revue de zoologie et de botanique africaines. Bruxelles.
Riv. Biol. colon.	Rivista di Biologia Coloniale. Rome.
Riv. for. ital.	La Rivista Forestale Italiana. Rome.
Roczn. Nauk. rol.	Rocznik Nauk Rolniczych [i Lesnych]. Kraków.
Rubb. Res. Inst. Malaya Circ.	Rubber Research Institute of Malaya Circular. Kuala Lumpur.
Rubb. Res. Inst. Malaya Plant. Bull.	Rubber Research Institute of Malaya Planters' Bulletin. Kuala Lumpur.
Schweiz. Z. Forstw.	Schweizerische Zeitschrift für Forstwesen. Bern.
Sci. Bull. Dep. Agric. For. S.Afr.	Department of Agriculture and Forestry Science Bulletin. Pretoria.
Sci. Mon., N.Y.	Scientific Monthly. New York.
Sci. Proc. R. Dublin Soc.	Scientific Proceedings of the Royal Dublin Society. Dublin.
Spec. Rep. For. Prod. Res., Lond.	Special Report. Forest Products Research. Department of Scientific and Industrial Research. London.
Statist. Bull. U.S. Dep. Agric.	Statistical Bulletin of the United States Department of Agriculture. Washington.
Sth. For. Exp. Sta. Occ. Pap.	Southern Forest Experiment Station Occasional Paper. New Orleans, La.
Sth. Lumberm.	Southern Lumberman. Nashville, Tenn.
Svensk bot. Tidskr.	Svensk botaniska Tidskrift. Stockholm.
Svenska SkogsvFören. Tidskr.	Svenska Skogsvårdsföreningens Tidskrift. Stockholm.
Tech. Bull. U.S. Dep. Agric.	United States Department of Agriculture Technical Bulletin. Washington.
Tech. Pap. Lond. Shellac Res. Bur.	Technical Paper. London Shellac Research Bureau.
Tech. Publ. Amer. Inst. Min. Engrs.	Technical Publications. American Institute of Mining and Metallurgical Engineers. New York.
Tharandt. forstl. Jb.	Tharandter forstliches Jahrbuch. Berlin.
Tidsskr. Skogbr.	Tidsskrift for Skogbruk. Oslo.
Timb. News Sawm. Engr.	Timber News [and Sawmill Engineer—and Machine Woodworker]. London.
Timb. Statist. Rev.	The Timber Statistical Review [and C.I.B. Monthly Bulletin]. London.
Trade Circ. For. Prod. Aust.	Trade Circular. Council for Scientific and Industrial Research. Division of Forest Products. Commonwealth of Australia. Melbourne.
Trans. Brit. mycol. Soc.	Transactions of the British Mycological Society. Worcester.
Trans. nat. hist. Soc. Formosa	Transactions of the Natural History Society of Formosa. Taihoku.
Trop. Agriculturist	Tropical Agriculturist and Magazine of the Ceylon Agricultural Society. Peradeniya.
Trop. Woods	Tropical Woods. New Haven, Conn.
Z. Forst- u. Jagdw.	Zeitschrift für Forst- u. Jagdwesen. Berlin.
Z. Weltforstwirt.	Zeitschrift für Weltforstwirtschaft. Neudamm.

Libraries other than that of the Imperial Forestry Institute from which literature was obtained for purposes of recording and abstracting in the present number of *Forestry Abstracts*.

Designation:	*Library of:*
A.P.B.	The Imperial Bureau of Pastures and Forage Crops. Aberystwyth.
L.S.	The Science Museum. London.
P.R.	The Forest Products Research Laboratory. Princes Risborough.
O.B.D.	The Department of Botany. Oxford.
O.R.E.	The School of Rural Economy. Oxford.
O.R.S.	Radcliffe Science Library. Oxford.

Publications of the I.A.B. referred to in this number:

R.A.E.	Review of Applied Entomology. London.
R.A.M.	Review of Applied Mycology. Kew.